AIRCRAFT CARRIER CLIMATE CONTROL INVESTIGATION TEAM (ACCCIT)

Heating Ventilation Air Conditioning (HVAC) Manual

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Heating Ventilation and Air Conditioning (HVAC) Manual

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Introduction

This Heating Ventilation Air Conditioning (HVAC) Manual was developed in conjunction with the Aircraft Carrier Climate Control Investigation Team (ACCCIT) Program and is a compilation of basic operating and replacement part ordering data for HVAC systems in surface ships. The intent is for ready reference and as a guide for preparing a management plan for cleaning and maintenance of HVAC systems. It is not intended to replace pertinent technical manuals.

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Chapter

1

I - The Management Plan

Establishing an HVAC system operation and maintenance plan.

1-1 Introduction

1-1a General

The operation of any HVAC system for a prolonged period will eventually result in large accumulations of dirt, grease, and other foreign material on the interior surfaces of the HVAC equipment and ductwork. These accumulations reduce the cross sectional area of the air passages and consequently, reduce the volume of air delivered within the ship to a level below that normally required for health and comfort of personnel. The procedures and responsibilities herein set forth provide an effective means of maintaining HVAC systems at maximum efficiency.

1-2b Responsibilities

The Engineering Officer has the overall responsibility for operation and maintenance of HVAC systems. He establishes, maintains, and coordinates the program for routine cleaning of all HVAC systems.

1-2b.1 All HVAC system components are covered by a Planned Maintenance System (PMS) and are under the cognizance of the Damage Control Petty Officers (DCPO's).

1-2b.2 Systems are assigned to either the division/work center owning the space in which the fan is located or to the division/work center that receives the major benefit (i.e. laundry, galley, main spaces).

1-2b.3 The owning division/work center is responsible for coordinating system cleaning.

1-2b.4 All divisions through whose space the system passes or serves shall assist in the cleaning.

1-2 Ventilation Team

1-2a Team Make-up and responsibilities

The Engineering Department shall establish the ventilation team, supervised by an officer or CPO. The team should consist of 6 to 10 members and should include an electrician and an AC&R qualified Petty Officer. The team's responsibilities are as follows:

1-2a.1 Man and operate the Filter Cleaning Shop.

1-2a.2 Assist the DCPO's in correcting problems beyond their technical capabilities.

1-2a.3 Provide limited classroom and on-the-job training to new DCPO's on PMS requirements.

1-2a.4 Provide technical assistance in all trouble calls involving HVAC systems and provide a discrepancy memorandum outlining corrective actions required.

1-2a.5 Notify division officers of required ventilation cleaning and schedule accomplishment.

1-2a.6 Monitor adherence to HVAC system cleaning schedules. Report non-accomplishments to the Engineering Officer to ensure timely corrective action.

1-2a.7 Maintain a complete file of all HVAC systems as explained in Chapter 3 -Vent & A/C Duct Cleaning Procedure.

1-2a.8 Develop and maintain Master Equipment Guide Lists (EGL's) for all HVAC equipment. OPNAVINST 4790.4 Refers.

1-2b Team Material

The replacement material most often required should be pre-positioned by the ventilation team. Table 1-1 is a suggested list of material:

QTY	ITEM	NSN/PART NO.	REMARKS
10	2PD THERMOSTAT	9N 5930-00-726-4371	CHAPTER 13
6	4X6 ACCESS COVER	JE153*	CHAPTER 16
6	6X8 ACCESS COVER	JE153*	CHAPTER 16
6	6" DIA ACCESS COVER	9G 2040-00-616-5407	CHAPTER 16
6	8" DIA ACCESS COVER	9G 2040-00-616-5409	CHAPTER 16
50 FT	½" X ½" SCREEN	NONE	.064 DIA WIRE
50 FT	1-1/2" X 1-1/2" SCREEN	NONE	.120 DIA WIRE

*Juniper Industries, Inc. Part Number. (Reference: Marine Ventilation Equipment Catalog, CAT-90A)

Table 1-1 Replacement Material

In addition to the material identified in Table 1-1, identify other material for replacement or repair as work progresses. Early identification of these items is important to facilitate procurement.

Chapter

2

II - Introduction to Ventilation and Air Conditioning

General knowledge and identification of HVAC systems.

2-1 Introduction

This chapter provides information about HVAC system function, type, classification, and identification. Troubleshooting the causes and identifying corrective actions for HVAC systems is also covered.

2-2 Function

The function of shipboard HVAC systems is to provide for habitability and the preservation of equipment and supplies under varying climatic conditions. The heat added, space occupied, and power consumed by the HVAC equipment must be at the expense of military requirements. Therefore, the minimum equipment is provided to maintain adequate supply of air circulation and exhaust. The HVAC system has three (3) major functions.

2-2a Habitability

The system must maintain habitable conditions that keep the crew physically fit and mentally alert by providing an atmosphere that will enable the body to maintain proper heat balance with air that is free from harmful components and has a sufficient oxygen supply.

2-2b Ammunition Preservation

Air conditioning or ventilation is provided for ammunition spaces to prevent deterioration of ammunition components due to adverse temperature conditions.

2-2c Temperature Control for Electrical Equipment

Ventilation and/or air conditioning is provided in spaces containing electrical/electronic equipment to limit the ambient temperature to equipment design specifications.

2-3 Airflow Measurement

The key components of airflow are velocity typically expressed in Feet Per Minute (FPM) and volumetric flow rate in Cubic Feet Per Minute (CFM).

2-3a Air Velocity

The velocity of the air in FPM flowing in a vent duct, is the distance in feet that a particle of air travels in the duct in one minute. Typical duct velocities are in the range of 1100 to 3100 FPM, or about 13 to 35 Miles-Per-Hour (MPH).

2-3b Air Volume

The volume of air in CFM coming out of or going into a terminal, is the amount of air measured in one-foot cubes per minute.

2-4 System Types and Classifications

2-4a System Type

There are three (3) types of systems in surface ships and they fall into two (2) categories, Mechanical and Natural.

2-4a.1 Supply

2-4a.2 Exhaust

2-4a.3 Recirculation

2-4b Ventilation

Ventilation systems are further subdivided into 1) Mechanical Supply; 2) Mechanical Exhaust; 3) Natural Supply and Exhaust; 4) Ventilation Blowout; 5) Air Conditioning, 6) Replenishment air and 7) By-pass Air. The term "mechanical" means there is a fan in the system while the term "natural" means there is no fan in the system.

2-4b.1 Mechanical supply systems, Figure 2-1 usually consist of a weather inlet, preheater and reheater (if required), fan, ductwork, and supply terminals. Fresh outside air is moved by fan pressure through the weather inlet and preheater, then distributed by ductwork to the ventilated space where it is discharged by terminals. The preheater (installed near or at the weather intake) heats the air sufficiently to prevent condensation on the supply ducts within the ship. Reheaters increase the temperature of the preheated air to maintain desired space temperature. Main machinery spaces are not equipped with preheaters. In certain hot spaces "spot cooling" is provided. This is accomplished by locating adjustable blast terminals near watch stations to provide high velocity outside air to cool operating personnel.

2-4b.2 Mechanical exhaust systems, Figure 2-1 consist of exhaust terminals (bellmouths), ductwork, a fan, and a weather outlet. Exhaust air may pass through heads or Passageways before being removed by an exhaust system. In a few cases a

mechanical exhaust may also include a flame arrestor (see Chapter 11 - Flame Arresters).

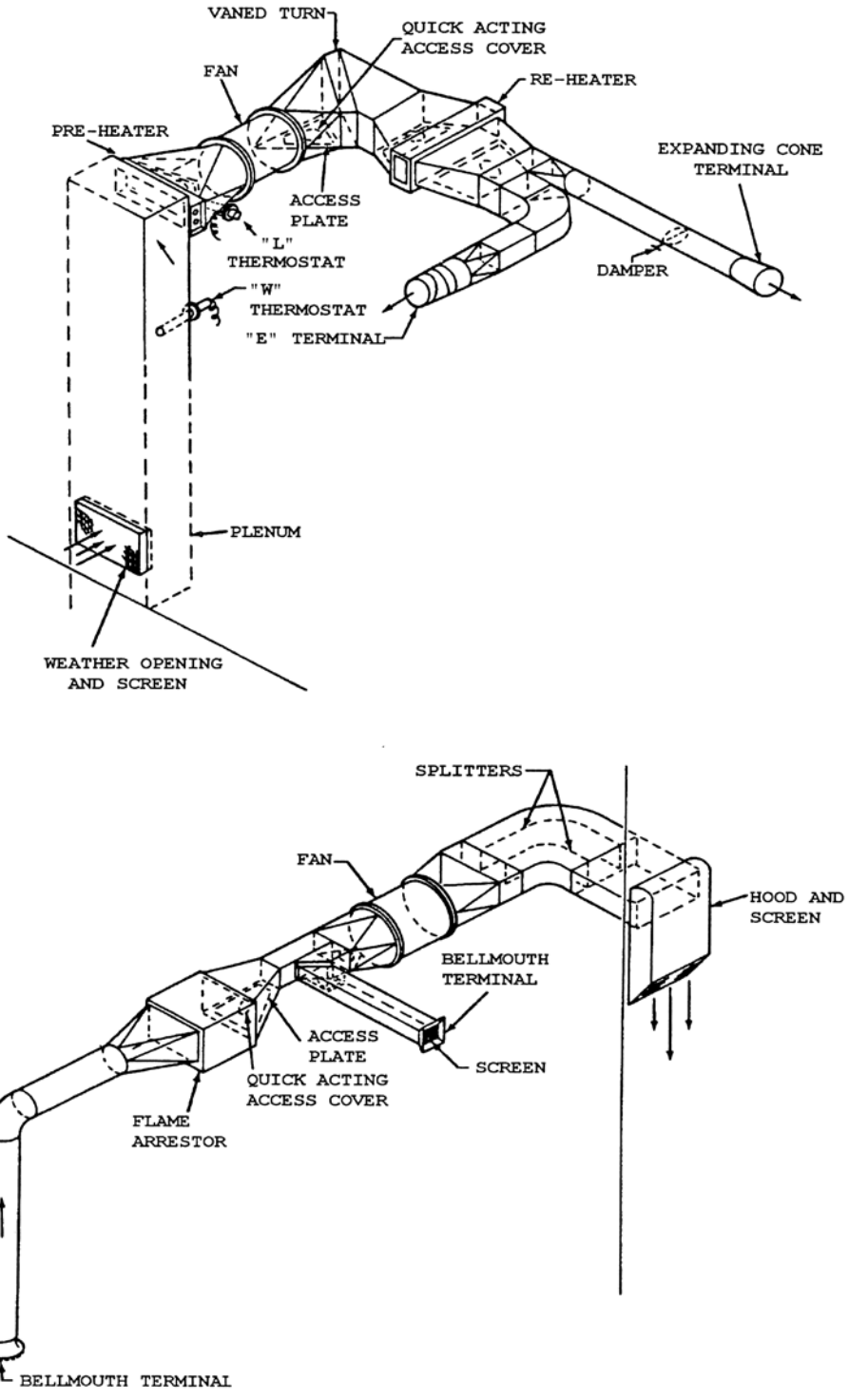


Figure 2-1 Typical Supply and Exhaust Ventilation System

2-4b.3 Natural supply and exhaust consist of weather openings and ductwork. A screen in the bulkhead on the interior is also a natural. Natural and mechanical systems are used together to avoid addition of needless fans and heaters, or to accomplish one of the following:

- A natural supply and mechanical exhaust may be used to create a negative pressure within a compartment, which minimizes undesired air movement from the space.

- A mechanical supply and natural exhaust may be used to create a positive pressure within a compartment, which will minimize air infiltration into the space.

2-4b.4 Ventilation blowout is furnished to magazines, to avoid oxygen depletion when the magazine is occupied. Blowout air is used when necessary but is normally closed-off.

2-4b.5 Air conditioning is normally provided by duct type recirculating systems (Figure 2-2), which employ reheaters and diffusing terminals. Impingement type filters are used upstream of the cooling coil to prevent rapid fouling of the finned elements.

2-4b.6 Replenishment air for air conditioning systems is furnished by ventilation supply systems that have a terminal near the recirculating system intake. A minimum of 5 CFM per man or one 75 CFM terminal per space is supplied for odor removal and oxygen replenishment. Supply and exhaust systems are normally balanced. Class W air conditioning systems other than those serving troop-berthing areas require 10 CFM per man or the 75 CFM branch minimum.

2-4b.7 By-pass air is provided for systems to prevent condensation, and in some cases to suit fan selection.

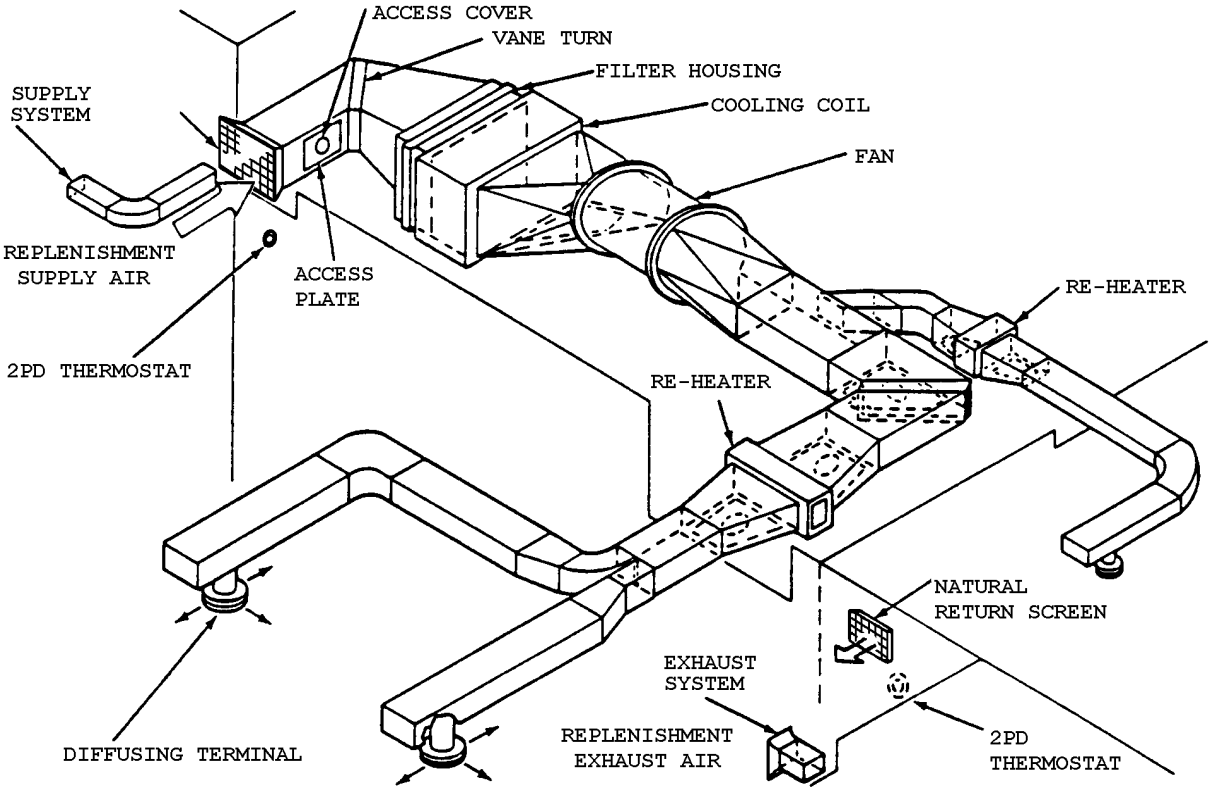


Figure 2-2 Typical Recirc System

2-5 Air Distribution Terminals

2-5a Introduction

Each type of system (see Chapter 4 – Ventilation Screens) is designed to use a different type of terminal. Terminals are arranged to prevent short-circuiting of air between supply and exhaust systems, so all areas of the space have airflow. Some exhaust terminals are placed directly over sources of hot air or fumes so the air does not move across work areas.

2-5b Exhaust Systems

Most exhaust terminals are the contracting duct or bellmouth types, refer to Figure 2-3 and Table 2-1. In air conditioned spaces, air is often exhausted from the space through a wire mesh bulkhead opening or through an "egg crate" or grilled ceiling opening (natural exhaust). Exhaust hoods are provided over ranges, griddles, steam kettles, dry cleaning equipment, etc., to remove smoke, grease, fumes and vapors (see Chapter 12 – Grease Interceptor Hoods). Some pieces of the equipment are directly connected to the space exhaust system to prevent hot air or fumes from entering the space. Bellmouth terminals are not currently in the National Stock Number System (NSN). To order replacement terminals use an industrial activity or order directly from a commercial manufacturer. The most important measurement is the "A" dimension or where it attached to the ductwork. The other dimensions may vary slightly from Figure 2-3 and Table 2-1.

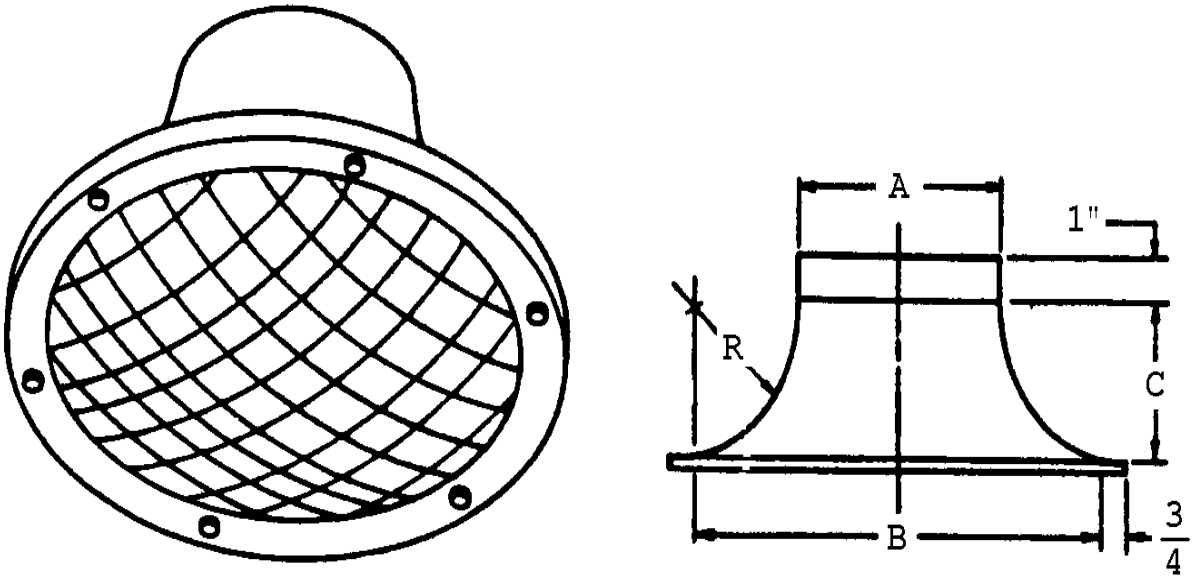


Figure 2-3 Bellmouth Terminal

PHYSICAL DATA			
"A" DIA (INS)	**"B" DIA (INS)**	**"C" (INS)**	**"R" (INS)**
3	5-1/4	1-1/2	1-13/16
3-1/2	6-1/8	2	1-13/16
4	7	2-1/4	2-7/16
4-1/2	7-7/8	2-3/4	2-3/4
5	8-3/4	3	3
5-1/2	9-5/8	3-1/4	3-5/16
6	10-1/2	4	3-5/8
6-1/2	11-3/8	4	3-5/16
7	12-1/4	4	4-1/4
7-1/2	13-1/8	5	4-1/2
8	14	5	4-13/16

Table 2-1 Bellmouth Terminals

2-5c Supply systems

Navy type "E" terminals (adjustable blast terminals) are generally used in manned heat producing spaces served by ventilation systems. This terminal is essentially a tubular flexible extension of the supply duct. The terminal can be adjusted to direct a stream of air in any direction desired, refer to Figure 2-4 and Table 2-2. When ordering "E" Terminals, specify corrosion resistant steel (CRES) per NAVSEA Standard Drawing 804-860481.

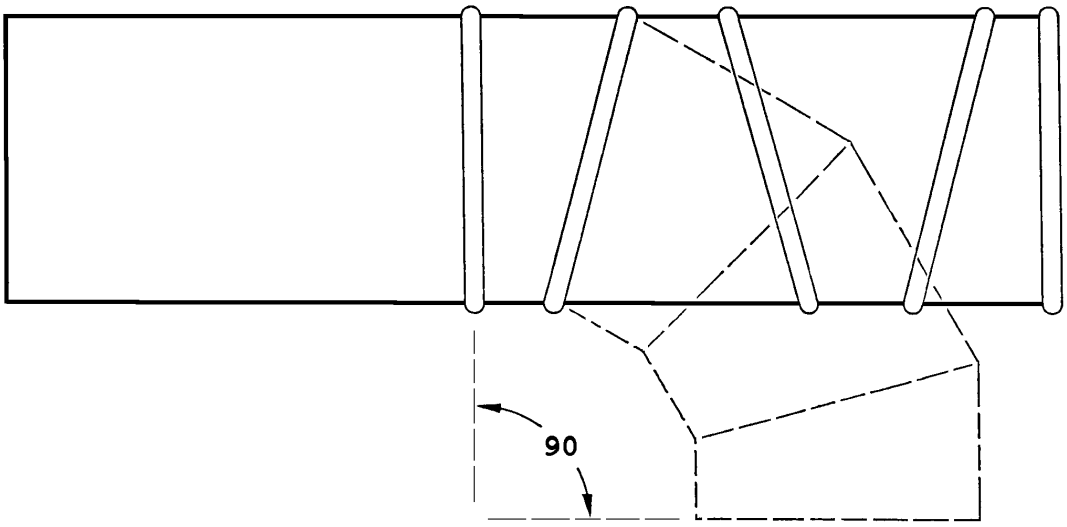


Figure 2-4 Navy Type "E" Adjustable Blast Terminals

PHYSICAL DATA			ORDERING DATA	
TERM NO.	INSIDE DIA	NO PER CASE	COG	NSN
724	3	20		PER NAVSEA STD DWG
725	3-1/2	20		804-860481
726	4	20		SPECIFY CRES
727	4-1/2	20		
728	5	20		
729	5-1/2	10		
730	6	10		
731	6-1/2	10		
732	7	10		
733	7-1/2	10		
734	8	10		
735	9	4		
736	10	4		
737	12	4		
738	13	4		
739	17	4		

Table 2-2 Navy Type "E" Adjustable Blast Terminal

2-5d Recirculation Systems

Diffusing terminals are employed in living spaces, offices and air conditioned shops. These terminals are designed to discharge a horizontal pattern in a manner that will cause thorough mixing with room air above the level of occupancy. Refer to Figures 2-5 and 2-6 and Tables 2-3 and 2-4. For details on Navy Standard Diffusing Terminals see NAVSEA STD drawing 804-690702.

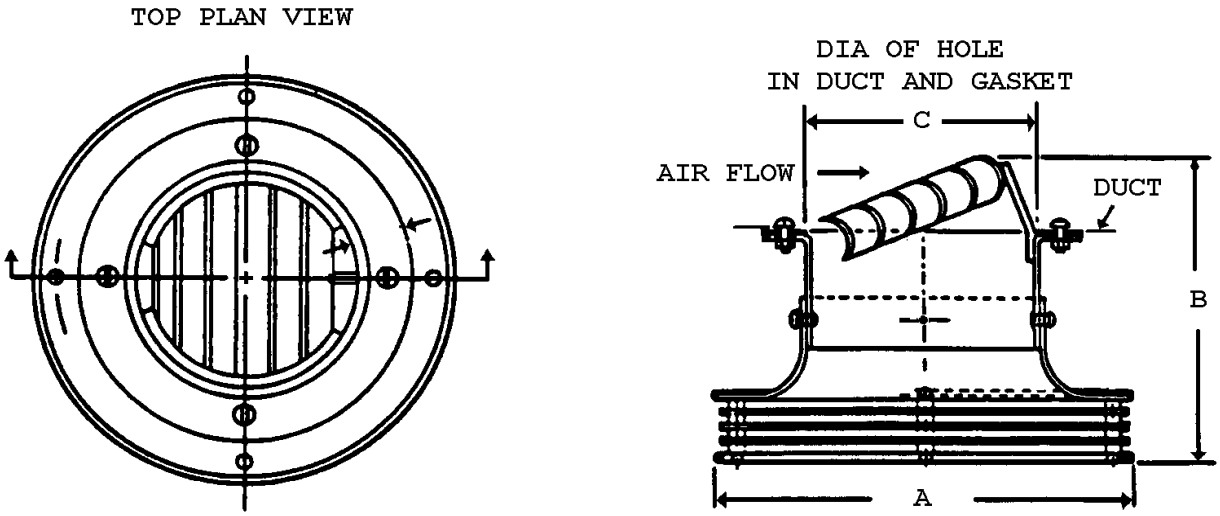


Figure 2-5 Navy standard diffusing terminals

PHYSICAL DATA							
	VOLUME RANGE	DIMENSIONS (INCHES)			NET WEIGHT (LBS)	ORDERING DATA	
SIZE	CFM	A	B	C		COG	NSN
3.5	75-150	3-1/2	7-1/4	4 -5/16	2	1H	4520-00-396-1688
4	130-200	4	9-1/8	4 -5/16	2-1/2	9C	4520-00-396-1689
5	205-310	5	10	4 -3/4	3	9C	4520-00-396-1690
6	295-450	6	13-1/2	4 -5/16	3-1/2	9C	4520-00-396-1691
7	400-615	7	14-1/8	5-9/16	4 -1/2	1H	4520-00-396-1692
8	520-800	8	17-3/8	5-3/4	5-1/4	9C	4520-00-396-1693
9	660-1015	9	17-3/4	6-7/16	6	9C	4520-00-396-1694
10	810-1250	10	20-5/8	6-5/8	8	9C	4520-00-396-1695
12	1175-1805	12	24-1/4	7-7/16	12	9C	4520-00-396-1696

Table 2-3 Navy standard diffusing terminals

SIZE (INS)	CORE STYLE	ORDERING DATA	
		COG	NSN 5640-01 *5670-01
6X6	20	9Q	*100-8213
6X6	22	9Q	100-9880
6X6	30	9Q	100-9077
6X6	40	9Q	101-3872
6X6	40	9Q	*101-3868
6X9	10L	9Q	101-3871
6X9	20	9Q	*101-3870
6X9	20S	9Q	100-8216
6X9	20L	9Q	100-9073
6X9	31	9Q	100-9082
6X9	33	9Q	101-3869
6X9	42	9Q	*100-8214
6X15	42	9Q	127-1963
9X9	20	9Q	100-8218
9X9	20	9Q	101-3867
9X9	30	9Q	100-8212
9X9	40	9Q	100-9079
6X12	20L	9Q	100-9074
6X12	20S	9Q	100-9076
6X12	31	9Q	100-9078
6X12	42	9Q	*100-8215
9X21	20L	9Q	102-1673
9X21	20L	9Q	100-8217
12X12	40	9Q	*238-6121
12X12	20	9Q	*100-9083
15X20	20L	9Q	100-9075

Table 2-4 Commercial Diffusing Terminals

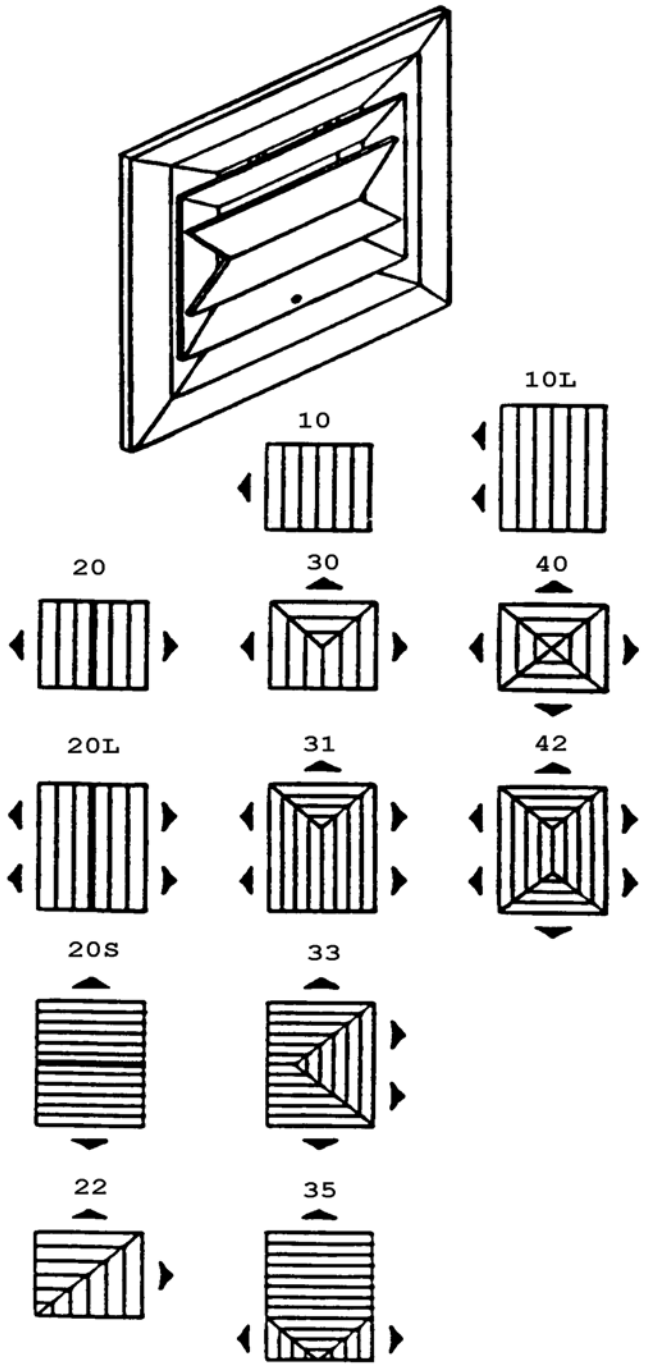


Figure 2-6 Commercial Diffusing Terminals

2-6 System Identification

2-6a Component Numbering

The components in the HVAC system are labeled for quick identification. Each major component is identified by a "ship's address" much like a house address. When one sees 123 Maple Street, one immediately knows how to find the building in a city or town. Major items on aircraft carriers are much the same. The major components are given three-number designations, such as 02-166-1 or 1-128-2, to indicate the location of the item on the ship. The first number indicates the level: 1 = Main Deck, 02 = Second Deck above the Main Deck. The second number is the frame number of the component location or, if the component lies between frames the number of the next frame forward. The third number indicates the sequence of the component from centerline. On the starboard side the numbers are odd, on the port side the numbers are even. Examples: Supply Fan 1-138-1 is on the Main Deck at Frame 138, nearest the centerline, on the starboard side, and Supply Fan 1-138-3 is the next fan outboard to starboard.

2-6b System Numbering

Although the cooling coils and heaters have their own number, the system number is determined by where the fan is located. A supply system, for example, may enter the ship on the 03 level and the last terminal might be on the 5th Deck. If the fan is located at 1-116-2 then the entire distribution system is numbered S1-116-2. The labels you will see on the ductwork and associated hardware will have this number no matter where they are located in the ship.

2-7 Troubleshooting

2-7a Introduction

First, it must be understood that all of the HVAC systems in a ship are interdependent. A recirculation system does exactly as the name implies recirculates the air within a given boundary. Each recirc system requires fresh outside air, and this is the job of a supply system. When you add air to a closed space in a ship there must be a way for it to get out. It goes out through an exhaust system. All three systems depend on each other and to achieve the design benefit all three must be operating. If the supply is not on, the ship will not receive fresh air. If the recirculation system is not operating properly it will not heat or cool the air. If the exhaust is not functioning stale air will accumulate. The first thing that must be known is what systems serve which space and where their controllers are located. Second, one must find the boundary of the recirculation system (the air condition boundary doors). If an air condition boundary door is left open or is missing, the recirculation system cannot overcome the outside air and will not function properly.

2-7b Ducted System Common Problems

When the systems are running and the boundaries are secure, one can start to troubleshoot the system by looking at one of the following four (4) major causes of inadequate air in a space.

2-7b.1 Accumulation of dirt in the duct and component parts.

2-7b.2 Unauthorized modification of HVAC systems.

2-7b.3 Unauthorized re-designation of space.

2-7b.4 Material deterioration of HVAC systems.

2-7c Corrective action

Once the probable cause of inadequate air in a space has been determined, the following corrective actions should be taken.

2-7c.1 Dirt accumulation. This is the major problem found in troubleshooting ducted systems. Corrective Action: A definite system of inspection and servicing is necessary to keep them clean. An entire section has been devoted to this subject (see Chapter 3 – Ventilation & Air Conditioning Duct Cleaning Procedures).

2-7c.2 Unauthorized "CREWALTS." These seemingly minor modifications can have a disastrous effect on a properly functioning HVAC system. These "CREWALTS" cause a disruption in the designed airflow pattern. They generally fall into three categories:

2-7c.3 Inspection covers or duct removed or damaged. This can modify the airflow and rob spaces downstream of airflow. It is a common mistake to remove access covers and cut holes into the ductwork or to remove the ductwork when the system is not functioning properly, to get more air into an area of the ship. Corrective Action: Order Quick Opening Access Covers (QOAC) by using information on Figure 16-5 and 16-6. If terminals are missing use Figures 2-4, 2-5 or 2-6 and Tables 2-1, 2-3 or 2-4 to reorder. If ductwork is damaged or missing, submit an Automated Work Request (AWR).

2-7c.4 Duct terminals blocked. Sometimes air terminals are blocked either intentionally or unknowingly. Most of the items found are: shoes or shower slippers in the intakes, laundry hung up to dry in front of supply terminals and gear adrift such as lockers or baggage. Corrective Action: Ship's Force should remove these items.

2-7c.5 Duct added by Ship's Force. This can be anything from cardboard to a very professional looking sheet metal duct, however, these semi-permanent additions do not take into account the air robbed from the original design and are not very efficient. Corrective Action: Ship's Force should remove these items.

2-7c.6 Redesignation of spaces. Numerous complaints are received concerning office spaces, work centers and shops with inadequate or no ventilation. Investigation generally reveals that the spaces involved are designated unmanned/unventilated spaces (storerooms, gear lockers, voids, etc.) that the ship has redesignated the spaces without authority. Corrective Action: Such changes in compartment function/designation can only be authorized by COMNAVSEASYSCOM. This includes modifications or additions to ventilation systems. Ship Alteration (SHIPALT) requests must be submitted where redesignation of a compartment is justified. This process allows technical review, determination of class applicability,

integrated logistical support where required, and documentation in Selected Record Plans when approved and accomplished. The procedure for submitting SHIPALT requests is outlined in CINCLANTFLT/CINCPACFLTINST 4790.3.

2-7c.7 Material deterioration. No matter what a ship's age, the ductwork begins to rust and corrode because of the environment (salt air). As the ductwork rusts through, holes will form allowing air to escape. Normally this will be beyond ships force capacity to repair. Corrective Action: Submit an Automated Work Request (AWR), making sure to tell what system it is (by number) and the sizes and location of the pieces that are affected. When possible, provide the applicable installation drawing number.

2-8 Damage Control Classifications of Fans & Closures

In order to limit the extent of damage to the ship due to flooding, fire, or contaminated air, all mechanically operated systems are classified in accordance with damage control requirements. There are (7) seven damage control classifications applicable to ventilation systems: 1) Circle X-ray, 2) X-ray, 3) Yoke, 4) Circle Zebra, 5) Zebra, 6) William, and 7) Circle William. Equipment and closures in a system are marked (X), X, Y, (Z), Z, (W), and W to correspond with the classification of the system. For damage control purposes, there are three material conditions of readiness for the ship shown in Table 2-5.

2-8a Damage Control Closures

The watertight and airtight closures fitted in the systems are for damage control purposes. In anticipation of damage, or after damage, these vent closures are closed. The operation of these closures is under the jurisdiction of the Damage Control Assistant. Their basic purpose is to:

- Prevent the spread of water from flooded to undamaged compartments through the ventilation ducts.
- Prevent the spread of fire or flashing.
- Reduce the entry of atomic, bacteriological, and chemical contamination.
- Permit the removal of smoke from fires in below-deck compartments.
- Permit the ventilation of interior spaces when authorized during General Quarters.
- Avoid supplying oxygen to fires or establishing a draft.

Closure and Equipment Marking	X-ray	Yoke	Zebra
(X)	Closures Closed Equipment Secured	Closures Closed Equipment Secured	May be operated during general quarters without special permission
X	Closures Closed Equipment Secured	Closures Closed Equipment Secured	Closures Closed Equipment Secured
Y	Closures Closed Equipment Secured	Closures Closed Equipment Secured	Closures Closed Equipment Secured
(Z)	Closures Open Equipment in operation	Closures Open Equipment in operation	May be opened at the discretion of the Commanding Officer
Z	Closures Open Equipment in operation	Closures Open Equipment in operation	Closures Closed Equipment Secured
(W)	Closures Open Equipment in operation	Closures Open Equipment in operation	Closures Open Equipment in operation
W	Closures closed and equipment secured when under atomic, bacteriological, or chemical attack. Closures open and equipment in operation at all other times.		

Table 2-5 Damage Control Settings and Equipment Status Chapter

MATERIAL CONDITION SETTINGS

Material Condition in effect	CLASSIFICATION			
	X	Y	Z	W
Xray	Closed	Opened	Opened	Opened
Yoke	Closed	Closed	Opened	Opened
Zebra	Closed	Closed	Closed	Opened

Maintain Watertight Integrity Discipline---Know Your Ship---
Set Material Condition Promptly and correctly---Maintain Them

Material Condition "Xray" in general, Material Condition "Xray" set when vessels are in no danger from attack, such as at anchor or secured at home base. When in this condition all ship's activities may proceed with minimum of interference and still the water tightness of the vessel is maintained.

Material Condition "Yoke" shall normally be set and maintained at a and import during WARTIME.

No door, hatch, scuttle, valve, or fitting required to be closed in the Material Condition being maintained may be opened without permission of the commanding officer through the damage control officer, or, in small vessels, through the officer of the deck. This applies as well to each facilities as ventilation, drainage, flushing, ect.

When requesting permission to open a fitting give name and rank or rate, fitting type, number, and classification; as well as reason for request. Report closure promptly.

Material Condition "Zebra" shall be set prior to going to sea or entering port during WARTIME.

Material Condition "Zebra" SHALL BE SET IMMEDIATELY AND WITHOUT FURTHER ORDERS WHEN MANNING GENERAL QUARTERS STATIONS. It will not interfere with access to battle stations.

In all cases, authority for deviation from material condition "Zebra" shall be obtained from the commanding officer through the damage control officer. Open fittings shall be guarded and personnel so organized and trained that the original setting can be immediately restored.

Exceptions to Paragraph 3.

Fittings assigned the classification of "Z" with a large black "D" surrounding it must be closed for darkening ship when darken ship is ordered. A list of these fittings is included in the darken ship bill.

Fittings assigned the classification of "Red Circle Z" are opened on authority of the commanding officer to set "Modified Condition Zebra" in order to prepare and distribute food, open limited sanitary facilities for use, ventilate battle stations, or cool vital spaces, such as magazines. Such fitting when open shall be guarded for immediate emergency closure.

Fittings assigned the classification of "Circle X or Circle Y" MAY BE OPENED WITHOUT SPECIAL AUTHORITY WHILE PROCEEDING TO OR FROM BATTLE STATIONS AFTER GENERAL QUARTERS HAS BEEN SOUNDED OR FOLLOWING SECURE. Other fittings so marked permit ammunition transfer and operation of vital systems, and shall be open only during the actual ammunition transfer or use.

Fittings assigned the classification of "Circle W are those normally kept open during action, but which must closed as defense against chemical, radiological, or bacteriologic attack to prevent contamination of the interior of the ship.

Maintain Maximum Water Tight, Firetight, and Fumetight Integrity---Stay Afloat

Chapter 3

III - VENTILATION AND AIR CONDITIONING DUCT CLEANING PROCEDURES

General knowledge and descriptions for maintenance of HVAC systems.

3-1 INTRODUCTION

3-2 GENERAL INSTRUCTIONS.

3-2a Description

Ventilation systems are composed of weather openings, fans, filters, cooling coils, heaters, closures, screens, ducts, terminals and controls. These components will deliver their maximum air quantities only as long as they are kept clean and functioning properly. A definite system of inspection and servicing is necessary to keep them clean. Comply with the schedule shown in Table 3-1.

Subsystem or Equipment	Type of System	MIP	Control Number	Requirement
Launch Valve Enclosure	Exhaust	6641/5	W32V	Annual
Machinery Spaces	Exhaust	6641/5	W32V	Annual
O2N2 Producing Rooms	Exhaust	6641/5	W32V	Annual
Laundry	Exhaust	6641/5	W32H	Monthly
Washrooms	Exhaust	6641/5	W32V	Annual
Galley, Bakery, and Pantry	Exhaust	6641/5	W32V	Annual
Vent Weather Closure	Sup/Exh	6641/5	W31Q	Annual
Vent Weather Openings	Sup/Exh	6641/5	W31Q	Annual
Ventilation Damper/Closer	Sup/Exh	6641/5	G93G	Annual
Clean/Inspect Vent Interior	Sup/Rec	6641/5	W32V	Annual
Lubricate Vent Closure Gears	Sup/Exh	6641/5	W32P	As Required

Table 3-1 Ductwork Maintenance Schedule

3-2b Dirt Accumulation

A great quantity of air passes through these systems and it is inevitable that dirt will collect on the various components. Most of this accumulation is within trunks and ducts where it is not readily noticeable.

3-2c Fire Hazards

Dirt accumulation not only reduces the air supply, it also constitutes a serious fire hazard. Laundry and galley exhaust ducts are the principal sources of such hazard. A clean duct is, to a certain extent, a flame arrestor because of the cooling effect of the metal in the duct. A dirty duct will act as a fuse and propagate a flame by igniting excessive accumulations of combustible matter along the duct's length.

3-2d Airflow Restriction

Swabs, deck gear, and trash should not be stowed in fan rooms or ventilation trunks as they restrict the airflow and increase the quantity of dirt and odors taken into the system. Ventilation terminals should not be used for stowing clothes, shoes, toilet articles, or other materials. Deck stowage arrangements should be such that weather openings for the ventilation systems and forced-draft blowers would not be restricted.

3-3 TRACING THE SYSTEMS

3-3a Responsibilities

The responsibilities for tracing each system and maintaining a complete file are described in Chapter 1, paragraph 1-2.b of the Management Plan.

3-3b Procedure

System Tracing Form (Figure 3-1) is to ensure an accurate recording of each system. The following instructions are provided as guidance for completing the system tracing form.

3-3b.1 BLOCK A of Figure 3-1 - Ship's Name. Identify the Ship's name completely. Example: USS NIMITZ (CVN 68).

3-3b.2 BLOCK B of Figure 3-1 - System Number. An example of a system number for a ventilation supply system is S02-126-3. A prefix (S) denotes supply, (E) an exhaust, and (R) a Recirculation system.

- RESPONSIBILITY - The Vent Shop has the responsibility for providing the system number.

- SOURCE - The originating document for the system number is the Damage Control Book (Fan List-column 1).

3-3b.3 BLOCK C - Tracing Responsibility Number. Responsibility for tracing each system (Figure 3-1, C) is marked on the tracing form in four digits, e.g., XX01 (work center which owns the fan).

- RESPONSIBILITY - The Vent Shop has the responsibility for providing the tracing number.

- SOURCE - The originating document for the tracing responsibility number is the Zone Inspection List.

3-3b.4 BLOCK D - Cooling Coil. The cooling coil number (e.g., 02-104-1) should be entered on the tracing form (Figure 3-1, D). Cooling coils are not a part of the supply or exhaust systems and the word NONE should be written in the coil block on the tracing form for these systems.

- RESPONSIBILITY - The DCPO owning the system has the responsibility for providing the cooling coil number.

- SOURCE - Numbers for the cooling coil should be taken from a label plate on the equipment. If there is no label plate, the number may be determined as described in Chapter 2-6 – System Identification, paragraph 2-6b System Numbering.

3-3b.5 BLOCK E - Controller Location. The controller location number (Figure 3-1, E) denotes the space the controller occupies (e.g., 2-121-5-Q).

- RESPONSIBILITY - The Vent Shop has the responsibility for providing the controller location number

- SOURCE - The originating document for the controller location number is in the Damage Control Book (Fan list, Column 2).

3-3b.6 BLOCK F - Heater. Supply and Recirculation Systems may have several heaters. All of the heaters, which are in the system, should be listed. The heater numbers (e.g., 3-106-1) should be written in the block marked (F) in Figure 3-1.

- RESPONSIBILITY - As with the cooling coil, the DCPO owning the system carries responsibility for the heater.

- SOURCE - The heater numbers may be found on a label plate attached to the equipment. If no label plate is attached, determine the number as described in Chapter 2-6 – System Identification, paragraph 2-6b System Numbering..

3-3b.7 BLOCK G - Power Panel Location. The power panel location number (e.g., 01-26-1) should be written in block (G) in Figure 3-1.

- **WARNING** - To avoid injury or death by electrocution, the Tag Out Procedures are a must. Ensure compliance with Forces Afloat, OPNAVINST 5100 series. Ensure all Tag Outs are in accordance with current shipboard instructions.

- RESPONSIBILITY - The DCPO owning the system has responsibility for the power panel location number.

- SOURCE - The number for the power panel location shall be found on a label attached to the controller. If there is no label, refer to the fan list.

3-3b.8 BLOCK H & I - Filter Size and Quantity. Filter size may be found in Figure 9-1 – Navy Standard Filter. These numbers (e.g., AF-11 for size and 2 for quantity) should be written on the tracing form (Figure 3-1, H and I) below the power panel location number.

- RESPONSIBILITY - Responsibility for the filter size and quantity numbers belong to the DCPO owning the system.

- SOURCE - Numbers for the filter size and quantity can be found by inspecting the equipment.

3-3b.9 BLOCK J - Terminal Location (Serves). Terminal location compartment number (e.g., 03-105-3-Q) should be written on the tracing form (Figure 3-1, J) in the blocks numbered 1 to 15.

- RESPONSIBILITY - The Vent Shop has responsibility for entering the terminal location numbers.

- SOURCE - Terminal location numbers may be found in the Damage Control Book (Fan List-Column 3).

3-3b.10 BLOCK K - Compartment Number. In the case of supply and exhaust systems, list the weather compartment number first. Follow the system to all terminals, recording every compartment in order of appearance. There are six blocks on the tracing form (Figure 3-1, K) for the compartment number (e.g., 03-46-5-Q).

- RESPONSIBILITY - Responsibility for entering the compartment number belongs to the DCPO owning the system.

- SOURCE - The compartment numbers have no originating document. They are found by physically tracing the system. (The ventilation system diagrams may be of assistance for this step. They can be found in the Ship's Information Book (SIB).)

3-3b.11 BLOCK L - Clean Out Accesses. List every access in each compartment. These accesses must be traced as with the compartment numbers. The access numbers are long and must be written legibly on the tracing form (Figure 3-1, L). Examples of access numbers are as follows: 18" X 24" Bolted or 6" FO Q O A C.

- RESPONSIBILITY - The DCPO owning system has responsibility for entering the access number.

- SOURCE - The access numbers are found by physically tracing the system.

3-3b.12 BLOCK M - Screens. Most systems have natural screens, which work in conjunction with the system. The numbers (Figure 3-1, M) must be listed so that they will be cleaned when the system is cleaned. Screen numbers denote the screen size (e.g., 10" X 12" or 8" 0 (round)).

- RESPONSIBILITY - Responsibility for entering the screen numbers belongs to the DCPO owning the system.

- SOURCE - The screen numbers are found by physically tracing the system.

3-3b.13 BLOCK N - Compartment Responsibility. List the work center owning the compartment (e.g., ER01) on the tracing form (Figure 3-1, N).

- RESPONSIBILITY - The DCPO owning the system has the responsibility for entering the compartment responsibility work center numbers.

- SOURCE - These numbers are found on the "bullseye" or yellow block attached to the bulkhead in each compartment.

3-3b.14 BLOCK O - Brief. Specifically identify problems with the system (e.g., 03-114-2-Q Security Space or 6" X 8" FO QOAC missing in 02-127-6-L). This is the report section of this form (Figure 3-1, 0).

- RESPONSIBILITY - Responsibility for this brief belongs to the DCPO owning the system.

- SOURCE - Problems noted on the brief are found by physically tracing the system.

3-3b.15 BLOCK P - By. The name of the person filling out the form (e.g., R.J. Jones) is written on the bottom of the tracing form (Figure 3-1, P).

3-3b.16 BLOCK Q - Date. The date the form is completed (e.g., 26 May 91) is written on the bottom of the tracing form (Figure 3-1, Q).

3-4 SYSTEM CHECK POINTS AND COVERAGE

3-4a Supply System Check Points

The supply system checkpoints are the hull screen, plenum chamber, preheater, fan, turn vanes, ductwork, reheater, access covers, and terminals.

3-4a.1 Hull screen is noted in Chapter 4 – Ventilation Screens and it is also covered under MIP 6641/5, W31Q.

3-4a.2 Plenum chamber is noted in Chapter 3 – Ventilation & Air Conditioning Duct Cleaning Procedures, as weather opening and it is also covered under MIP 6641/5, W31Q.

3-4a.3 Preheater is noted in Chapter 7- Navy Standard Vent Heaters and it is also covered under MIP 6641/5, W31H.

3-4a.4 Fan is noted in Chapter 5 – Navy Standard Fans, and it is also covered under MIP 6641/5, X49C, X51H and W71N.

3-4a.5 Turn Vanes. MIP 6641/5, W32V, covers the turn vanes.

3-4a.6 Ductwork. The ductwork is noted in paragraph 3-2a and it is also covered under MIP 6641/5, W32V.

3-4a.7 Reheater. The reheater is noted in Chapter 7 - Navy Standard Vent Heaters and it is also covered under MIP 6641/5, W31W.

3-4a.8 Access Covers. The access covers (shown on Figures 16-5 thru 16-7 and Tables 16-7 thru 16-10D) are covered by PMS 6641/5, W32V. Quick opening Access Covers (QOAC) are for inspection and cleaning purposes only and must be closed when system is in operation.

3-4a.9 Terminals. MIP 6641/5, W32V, covers the terminals noted in Chapter 2 paragraph 2-5c Supply Systems Figure 2-4 Navy Type "E" Adjustable Blast Terminal.

3-4b Exhaust System Check Points

The exhaust system check points are the hull screen, plenum chamber, ductwork, fan splitters and turn vanes, access covers, terminals, natural screens, and flame arrestor.

3-4b.1 Hull Screen. The hull screen is noted in Chapter 4 – Vent Screens and it is also covered under MIP 6641/5, W31Q.

3-4b.2 Plenum Chamber. The plenum chamber is noted in Chapter 3 – Ventilation & Air Conditioning Duct Cleaning Procedures as a weather opening and it is also covered under MIP 6641/5, W31Q.

3-4b.3 Ductwork. The ductwork is noted in paragraph 3-2a and it is also covered under MIP 6641/5, W32V.

3-4b.4 Fan. The fan is noted in Chapter 5 – Navy Standard Fans and it is also covered under MIP 6641/5, X49C, X51H, and W71N.

3-4b.5 Splitters and Turn Vanes. Covered under MIP 6641/5, W32V covers splitters and turn vanes.

3-4b.6 Turn vane requires an access cover in the duct, on the upstream side, for inspection and cleaning purposes. These also require periodic cleaning.

3-4b.7 Access Covers. Access covers are covered under MIP 6641/5, W32V (refer to Figures 16-5 through 16-7 and Tables 16-7 through 16-10D). Quick Opening Access Covers (QOAC) are for inspection and cleaning purposes only and must be closed when the system is in operation.

3-4b.8 Terminals. MIP 6641/005, W32V, as noted on Chapter 2 – paragraph, 2-5c Supply System, Figure 2-4 covers the terminals.

3-4b.9 Natural Screens. MIP 6641/005, W32V, covers natural screens as noted in Chapter 4 – Vent Screens. Careful inspection must be made of all spaces that have terminals; so natural supply screens can be located which are associated with the exhaust system. These screens are part of the system airflow path even though they are not directly attached to the system.

3-4b.10 Flame arrester. The flame arrester is noted in Chapter 11 – Flame Arresters and it is also covered under MIP 6641/005, W32D.

3-4c Recirculation System Check Points

The component parts in a recirculation system must be completely understood before maintenance is attempted. This is covered in Chapter 2 – Introduction to Ventilation & Air Conditioning. Although each recirculation system has all of these items, they can be arranged differently in a given system, causing different maintenance problems.

3-4c.1 Filter. The filter is noted in Chapter 9 – Navy Standard Air Filters and it is also covered under MIP 6641/5, W31G.

3-4c.2 Cooling Coil. The cooling coil is noted in Chapter 8 – Cooling Coils and it is also covered under MIP 6641/5, A8LG, B8XE, W31Y, X49C, Y31T and Y31V.

3-4c.3 Fan. The fan is noted in Chapter 5 – Navy Standard Fans and it is also covered under MIP 6641/5, X49C, X51H, and W71N.

3-4c.4 Reheater. The reheater is noted in Chapter 7 – Navy Standard Vent Heaters and it is also covered under MIP 6641/5, W31N.

3-4c.5 Duct. The duct is noted in paragraph 3-2a and is covered under MIP 6641/5, W32V.

3-4c.6 Terminals. The terminals as noted on Figures 2-5 and 2-6 are covered under MIP 6641/5, W32V.

3-4c.7 Recirculation Returns and Naturals. PMS does not cover recirculation returns and naturals however, both items have screens and the PMS requirements for screens (MIP 6641/5, W32V) should be used to maintain these items.

3-5 DUCT CLEANING OTHER THAN REQUIRED PMS

3-5a Introduction

Every system on the ship will accumulate dirt; however, every system is not completely covered by PMS. Cleaning a complete system can be an easy process, but it does involve some planning and coordination. There are several things to be taken into account when planning to clean a complete system: Tracing the system as described in Chapter 3-3; Identifying responsible individuals as determined by system tracing; Identifying affected compartments, people and equipment and notification of anticipated downtime; Coordination of individual cleaning efforts if the system passes through spaces other than those of the division/work center responsible for the system. The responsible division/work center therefore must carefully plan in advance the cleaning requirement and work closely with the vent team to ensure a smooth operation with minimum disruption of service.

3.5b Fan Listing

Every ship has a Damage Control Book and within that book is a list of fans (sample shown on Table 3-1).

3-5b.1 Column 1 shows the system number and type of system.

3-5b.2 Column 2 shows the fan's physical location by compartment. It also shows the location of the controller for that fan.

3-5b.3 Column 3 shows the compartments ventilated or where the terminals are located by compartment.

3-5b.4 Column 4 shows the system's damage control classification.

A) USS	B) SYSTEM NO.	C) RESP
D) COOLING COIL	E) CONTROLLER LOCATION	F) HEATER
G) PWR PANEL LOCATION	H) FILTER SIZE	I) QUANTITY

J) TERMINAL LOCATION (SERVES)

1)	6)	11)
2)	7)	12)
3)	8)	13)
4)	9)	14)
5)	10)	15)

SYSTEM TRACE

K) COMP"T NUMBER	L) ACCESSES	M) SCREENS	N) RESP

O) BRIEF: _____

P) BY: _____ Q) DATE _____

Figure 3-1. System Tracing Form

System and Type	location	Compartment ventilated		Class	Division Responsibilities
03 LEVEL (Cont)					
**03-108-1	03-106-3-Q	01-102-1-L	Passage	(W)	
Exhaust	SquadronWk Ctr	01-104-3-Q	Squadron Office		
	(CF 03-110-3-L	02-106-1-L	Crew WR and WC		
		03-100-1-Q	Squadron Office		
		03-100-3-Q	Squadron Wk Center		
		03-100-5-Q	Squadron Wk Center		
		03-110-1-L	S-1 Office		
03-111-1	03-110-5-Q	01-120-3-L	Passage	W	
Recirc	Fan Room	02-106-3-Q	Camera Maint Shop		
	(CE 03-110-3-L)	02-106-5-Q	Film Loading Room		
		02-113-1-Q	Vestibule		
03-113-3	03-107-1-Q	01-115-5-Q	Filter Cleaning Shop	Z	
Supply	Fan Room	02-110-3-L	Crew Living Space		
		03-110-5-Q	Fan Room		
		03-115-1-M	Pyro Magazine		

**Remotely Controlled

Table 3-1. Sample Fan Listing (from Ship's Damage Control Book)

Chapter

4

IV - VENTILATION SCREENS

General knowledge of ventilation screens.

4-1 INTRODUCTION

This chapter describes the requirements for screens on natural and mechanical ventilation systems. Screens are installed to prevent the fouling of fans, ducts, and fittings, and to prevent injury to personnel.

4-2 REQUIREMENTS

4-2a Screen sizes

4-2a.1 Weather and exhaust intakes of ventilating systems are fitted with aluminum or galvanized steel screens of 1-1/2-inch mesh, except when the intake diameter is nine inches or less or when rat proofing is required, in which cases the screens must be 1/2-inch mesh.

4-2a.2 Terminals in the natural supply ducts in spaces that may contain explosive vapors or flammable liquids, as well as natural supply intakes and natural exhaust outlets of ammunition spaces, are fitted with number eight-mesh aluminum or galvanized steel wire screens.

4-2a.3 All mechanical exhaust, natural supply, and natural exhaust openings to weather shall have 1/2-inch mesh screen except those systems serving machinery spaces where the above criteria shall be applicable.

4-2a.4 If the foregoing would result in multiple screens, only the fine mesh screen shall be installed. A second screen shall be installed where a fine mesh screen needs support. Screens shall not be fitted on the face of heaters or the discharge side of fans that exhaust into uptake spaces except as required to prevent injury to personnel.

4-2b Screen construction

4-2b.1 Screens and their companion frame, braces, and fasteners shall comply with the requirements for dissimilar metals.

4-2b.2 Screens shall be galvanized steel or aluminum wire. Refer to Figure 4-1. Wire diameters shall be as follows:

- 1-1/2 inch wire mesh - 0.120 inch
- 1/2 inch wire mesh - 0.063 inch for interior locations, 0.108 inch for locations in the weather
- Eight mesh screen - 0.035 inch

4-2c Expanded and perforated metal

Expanded metal and perforated metal shall not be used on ventilation systems at any time as they diminish the designed airflow. Refer to Figure 4-2 and 4-3.

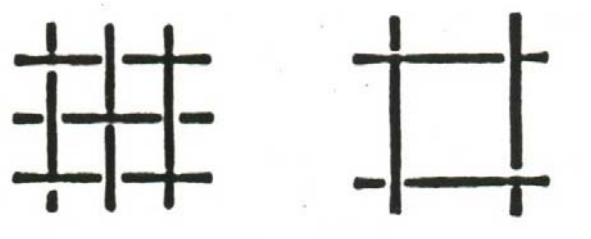


Figure 4-1 Wire Mesh Screen

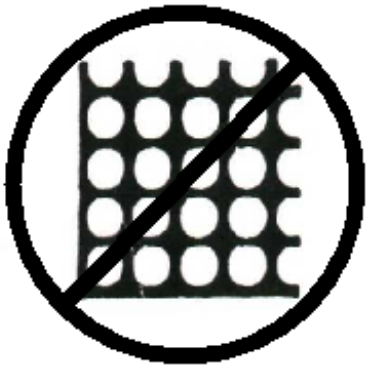


Figure 4-2 Perforated Metal

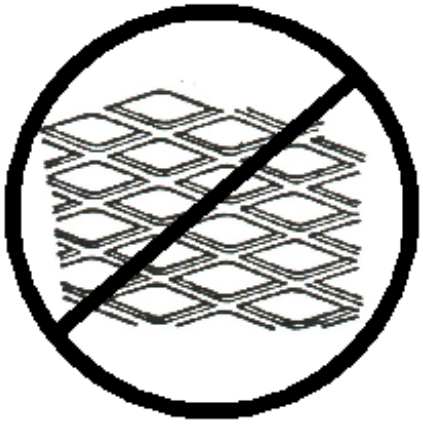


Figure 4-3 Expanded Metal

4-2d PMS requirements

Ventilation screen PMS requirements are listed in Table 4-1. They are taken from the Maintenance Index Page 6641/005, W32V.

Item	Type of System	MIP	Control Number	Requirement
Ventilation/Screens	All	6641/005	W32V	Annual

Table 4-1. PMS Requirements for Wire Mesh Screens

Chapter

5

V - NAVY STANDARD FANS

General knowledge of HVAC fans.

5-1 INTRODUCTION

The movement of air is accomplished by fans either installed or portable. Only installed units will be discussed in this section. Fans are classified broadly as centrifugal, axial, and bracket. Bracket fans are not directly a part of ventilation or air conditioning systems and so are covered only briefly.

5-2 VANEAXIAL FANS

5-2a Availability

These fans, the most commonly used for shipboard ventilating and air conditioning systems, are available in twenty three (23) sizes, ranging from A-1/4 to A-30, and in accordance with MIL-F-18953, Figure 5-1 and Table 5-1.

5-2b Fan motors

The fan motors can be either single speed or two speeds. Standard designations are shown in Table 5-1. Because the motor is located in the air stream, this fan type shall not be used where an explosion-proof requirement must be met.

5-2c Fan blade

The blade on a fan is called an impeller; the air always flows into the impeller and through the fan.

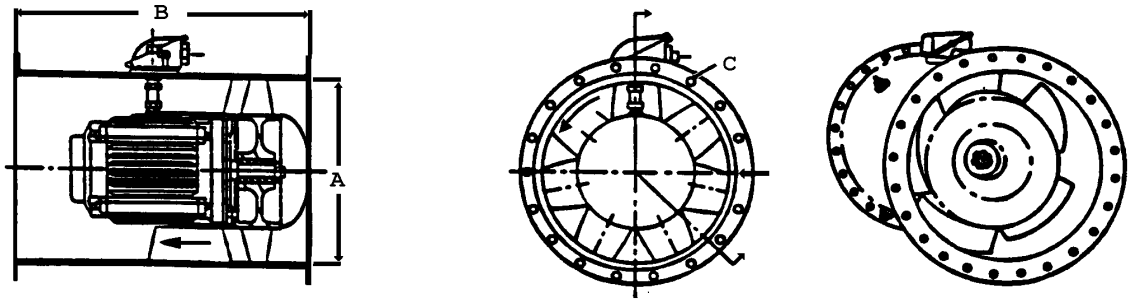


Figure 5-1 Vaneaxial Fan

PHYSICAL DATA										NSN
FAN SIZE	MOTOR H.P.	RATED RPM	AMPS LOW	SPEED HIGH	AMPS LOCKED ROTOR	A	B	BOLT HOLES C	COG	4140-00-*4140-01-
A 1/4	1/5	3450	N/A	0.5	3.5	9.75	15.375	12	9G	554-8180
A 1/2	1/3	3450	N/A	0.7	4.5	10.5	15.375	14	9G	554-8203
A1	1	3450	N/A	1.4	10.0	12.75	19.375	16	3H	289-8801
A1 1/2	1.25	3450	N/A	1.7	13.7	14.25	20	20	9G	045-4586
A2	1.5	3450	N/A	2.2	15.0	15.5	26	18	9G	289-8885
A2 1/2	2	3450	N/A	3.0		15.5	24	18	9G	*115-5972
A3	3	1150/1750	2.2	4.3	25.0	21.125	29.625	24	9G	289-8863
A3 1/2	3	1750	N/A			22.125	26	24	9G	*093-5301
A4	4	1150/1750		5.2	32.3	22.125	29.625	24	9G	176-4761
A4 1/2	5	3450	N/A	6.9	41.0	18	27.125	24	3H	554-8143
A5	4	1150/1750	2.9	5.7	32.3	23.25	29.625	26	9G	554-8209
A6	5	1150/1750	4.9	7.1	41.0	25.125	29.625	30	3H	*017-7330
A7	7.5	1750/3450		10.0	60.0	19.5	32	28	1H	554-8144
A8	6	1150/1750		8.6	51.6	27.25	32.25	30	3H	554-8214
A10	7.5	1150/1750	5.4	10.5	60.0	29.25	32.25	32	9G	554-8187
A11	12.5	1150/1750		16.2	92.5	31.25	40.125	36	1H	554-8189
A12	10	1150/1750		13.0	74.0	29.25	37.875	32	9G	289-8783
A16	15	1150/1750		20.0	105.0	31.25	37.875	36	9G	289-8807
A17	17.5	1150/1750		22.7	124.0	34.25	42	44	9G	289-8806
A20A	17.5	1150/1750	7.7	23.0	124.0	36	38.875	40	9G	516-5002
A25	25	870/1750		31.5	165.0	42.25	52	46	3H	289-8892
A28	25	1150/1750		31.5	165.0	36	50	40	9G	289-8894
A30	25	870/1750		31.5	165.0	44.25	52	48	9G	289-8823

Table 5-1 Vanaxial Fan

5-3 CENTRIFUGAL FANS

5-3a Availability

These fans are available as Type "CC" or Type "C" fans. Both type fans conform to MIL-F-19004. All Centrifugal fan sizes, except CC1/4, have backward curved fan wheel blades. The CC1/4 has forward curved fan wheel blades.

5-3b Type "CC" fan

Type "CC" is the more recent design of fan and is to be used for new installations. The Type "CC" fan, which has substantially the same volume-pressure characteristics as the Type "C" fan, is preferred because of lower cost, quieter operation, and stronger construction (more shock resistant). The Type "CC" fan is available in eleven (11) sizes. For details see NAVSEA STD drawing 803-5001058. Refer to Figure 5-2 and Table 5-2.

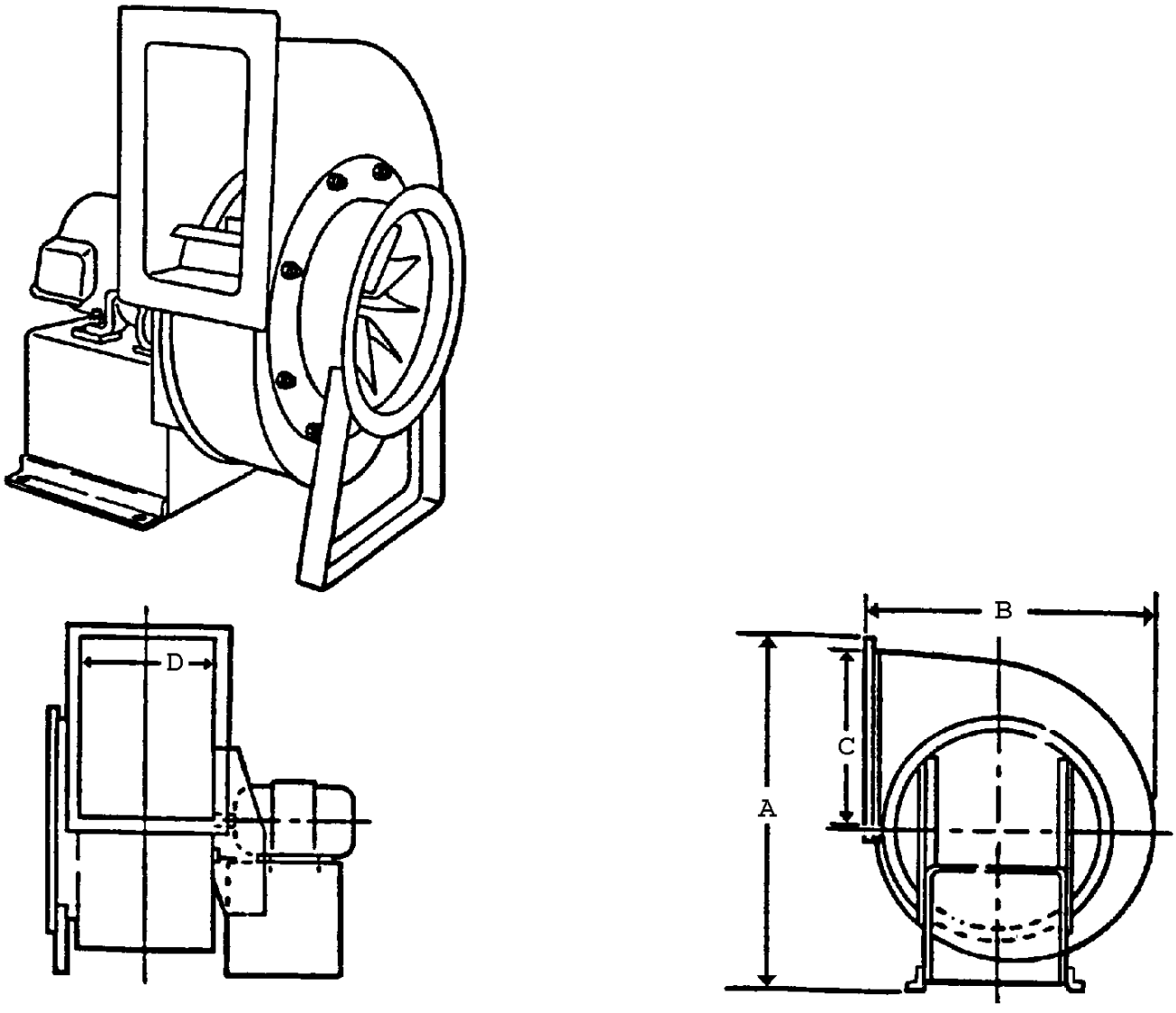


Figure 5-2 Centrifugal Fan Type “CC”

PHYSICAL DATA			DIMENSIONS (INCHES)				ORDERING DATA		
FAN SIZE	MOTOR H.P.	RATED RPM	A	B	C	D	ROTN	COG	NSN 4140-00 *4140-01
CC 1/4	1/4	1750	19 3/16	16 3/4	5 3/4	4 3/4	CW CCW	3H 9G	554-8456 554-8455
CC 1/2	1/2	1750	27 1/2	22 29/32	11	4 3/16	CW CCW	9G 9G	554-8559 *017-6183
CC1	3/4	1750	29 3/16	24 3/16	11 9/16	5 7/8	CW CCW	9G 9G	289-9263 554-8570
CC 1/2	1	1750	31 5/8	25 13/16	14 1/2	10 3/8	CW CCW	9G 7H	*160-8934 541-8059
CC2	1 1/2	1750	33 3/8	27 7/16	16 1/8	11 1/2	CW CCW	9G 1H	289-4305 *088-0401
CC3	3	1750 1150	41 1/4	33	19 3/8	11 3/4	CW CCW	9G 3H	289-4303 289-4304
CC4	4	1750 1150	44 7/8	35 15/16	21 1/2	12 7/8	CW CCW	3H 9G	726-2406 *034-1136
CC5	5	1750 1150	44 7/8	35 15/16	21 1/2	13 3/4	CW CCW	9G 3H	289-9235 881-3257
CC6	5	1750 870	60 3/8	47 1/2	29	18	CW CCW	9G	*196-0121
CC8	7 1/2	1750 870	66 7/8	53 3/8	32 1/4	19 3/8	CW CCW	9G 7H	456-6139 *618-3561
CC10	10	1750 870	66 7/8	53 3/8	32 1/4	20 6/16	CW CCW	9G	*154-2216

Table 5-2 Centrifugal Fan Type "CC"

5-3c Type "C" fan

The Type "C" fan was provided in ten (10) sizes, Figure 5-3 and Table 5-3.

5-3d Application limits

The centrifugal fan has the following limited applications: replacements in repair or alterations, conditions with an explosion-proof requirement, and conditions where the temperature of air handled is above 150°F (65°C).

5-3d.1 The fan motors can be either single speed or two speeds.

5-3d.2 The airflow in a centrifugal fan is always into the round opening and out of the rectangular opening. See Figure 5-4.

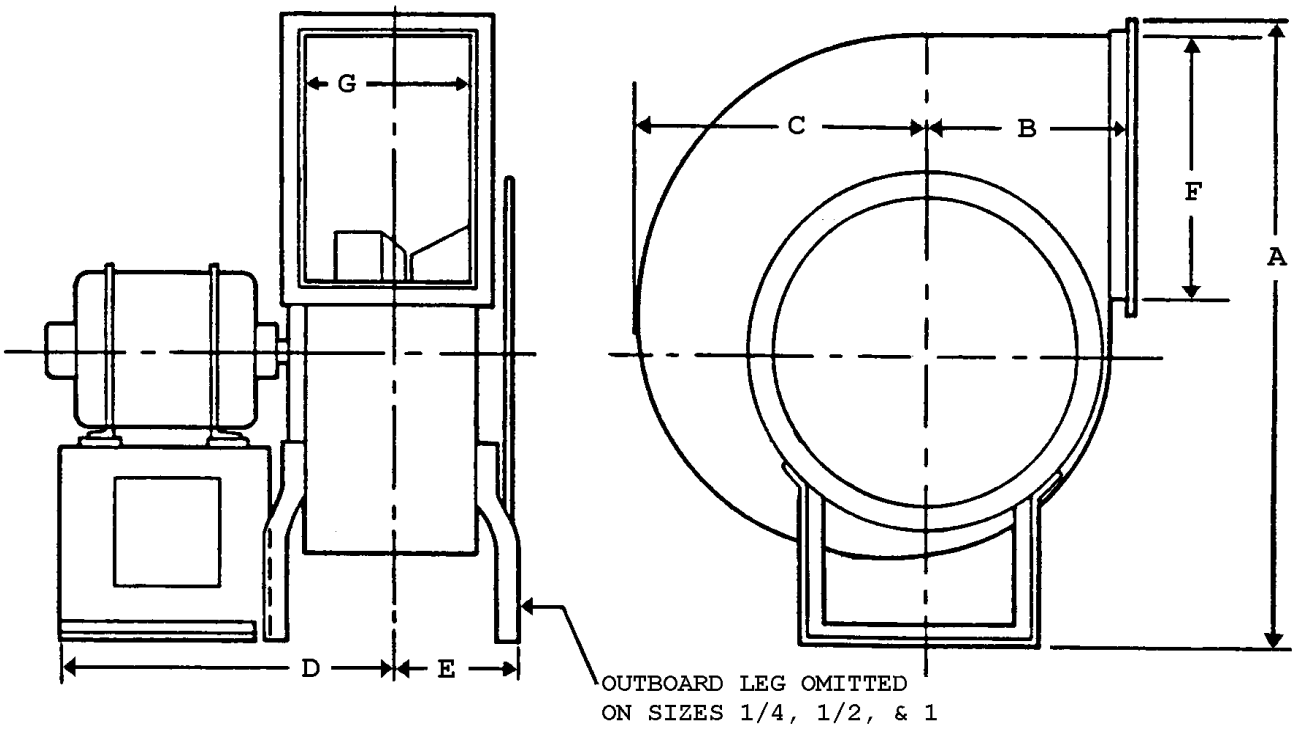


Figure 5-3 Centrifugal Fan Type "C"

PHYSICAL DATA									
FAN	MOTOR	RATED	DIMENSIONS (INCHES)						
SIZE	H.P.	RPM	A	B	C	D	E	F	G
C 1/4	1/4	1750	19 1/16	8 3/8	8 3/8	11 1/4		5 3/4	4 3/4
C 1/2	3/4	1750	19 1/2	8 1/2	8 3/4	17 3/4		6 7/16	5 1/2
C1	1	1750	20 3/4	9	8 7/8	18 3/4		9 3/4	7 1/2
C2	1 1/2	1750	34 3/4	13 3/4	13 3/8	19 7/8	9 7/8	15	9 1/2
C3	3	1140/1740	40 3/8	15 1/2	14 31/32	21 7/8	10 5/8	15 7/8	14 1/16
C4	4	1140/1740	51 7/32	15 1/2	22 1/16	25 1/8	11 5/8	21 3/4	12 3/4
C5	5	1140/1740	53 5/16	16	22 29/32	26 3/8	12 7/8	22 1/2	13 1/4
C6	5	870/1760	54 1/8	19 3/4	24 3/8	28 1/2	13	23 3/16	17 3/8
C8	7 1/2	870/1760	57 7/8	21	26 1/8	30 3/4	14	24 7/8	18 5/8
C10	10	870/1760	60 1/8	21 3/4	25 13/16	31 1/2	14 3/4	21 3/4	20 1/2

Table 5-3 Centrifugal Fan Type "C"

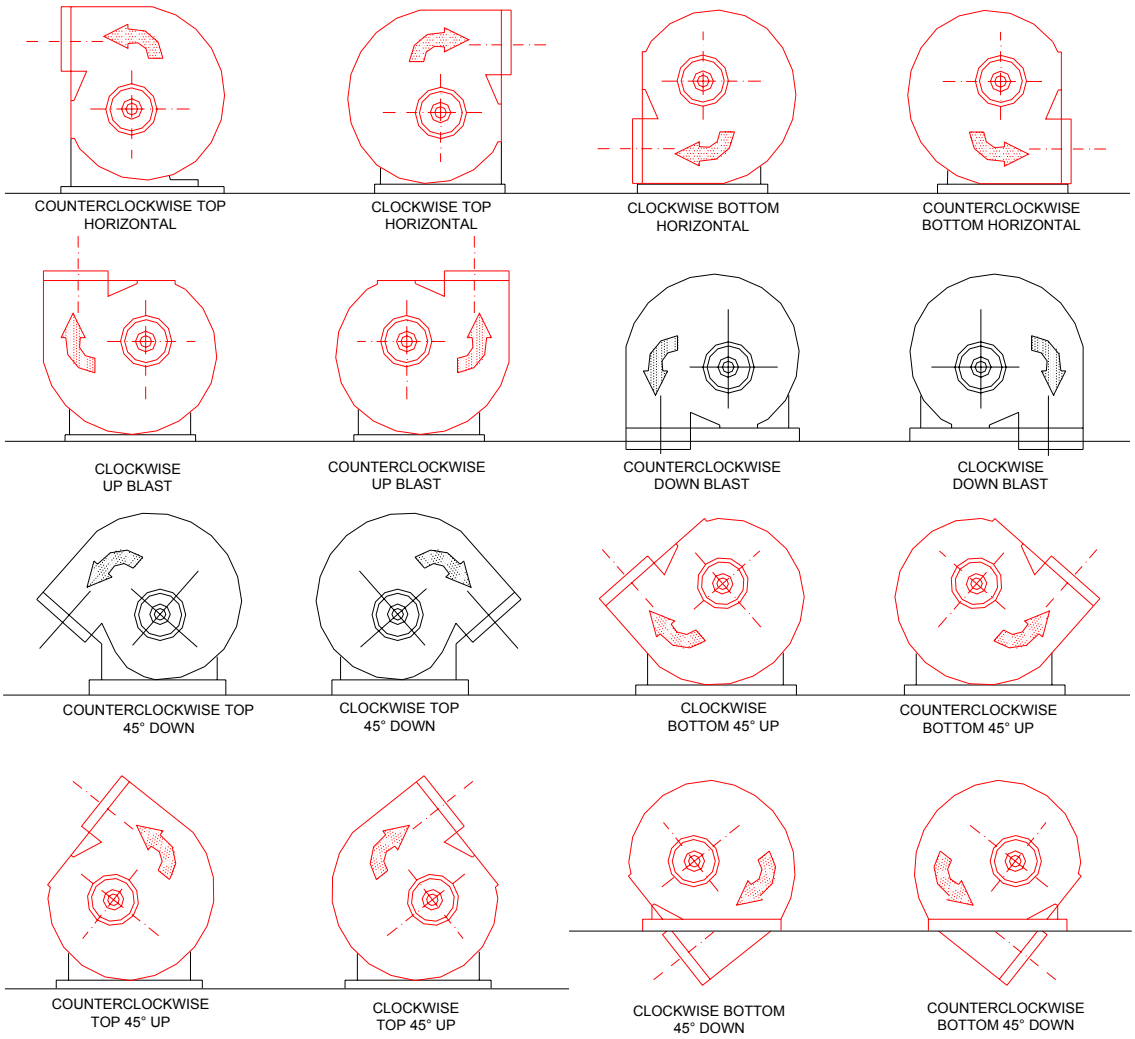


Figure 5-4 Centrifugal Fan Discharge Diagram

5-4 BRACKET FANS

Bracket Fans, MIL-F-68, refer to Figure 5-5 and Table 5-4, are provided for ventilated issue rooms, shops, and electronic spaces at the rate of one fan per space plus an additional fan for each 300 square feet (or portion thereof) of deck area. If additional bracket fans are to be installed, care must be taken to ensure that they are positioned to assist the existing airflow rather than blowing counter to it.

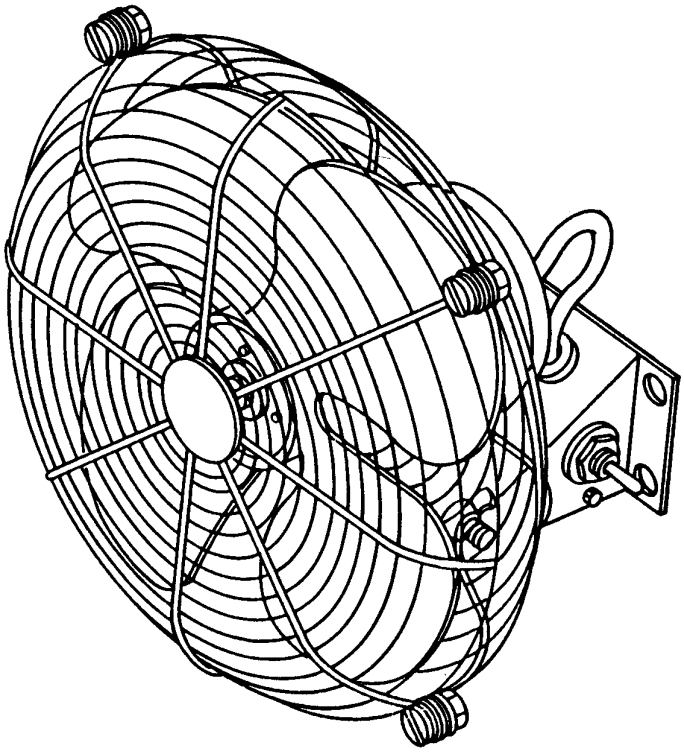


Figure 5-5 Bracket Fan

SIZE	ORDERING DATA	
	COG	NSN
12	9G	4140-00-255-7799

Table 5-4 Bracket Fan

5-5 NAME PLATE DATA

5-5a Fan Differentiation

Fans are differentiated by type, size, voltage/current requirements, motor enclosure, maximum ambient temperature, properties of construction materials, direction of rotation, and general design characteristics. These characteristics are spelled out in Table 5-5, which depicts the alternate letter-figure sequenced code used to classify shipboard Navy Standard Fans.

Symbol Sequence	Characteristic	C o d e	Meaning
1 (letter)	Type of fan	Type A-Vaneaxial	---
		Type L-Tubeaxial	
		Type 0-Portable	
		Type C-Centrifugal	
		Type CC-Centrifugal	(New)
2 (figure)	Fan size	For size code, see	Nominal cfm of
		Figures 5-1, 5-2, 5-3.	standard air in thousand
3 (letter)	Type of current	A	A C
		D	D C
4 (figure)	Voltage and phase	1/8	12 volt DC
	(frequency of AC is	1/4	24 volt DC
	60 Hz)	1/3	32 volt DC
		1	115 volt, single phase AC or 115 volts DC
		2	220 volt, 3 phase AC or 230 volt DC
		4	440 volt, 3 phase AC
5 (letter)	Motor enclosure	W	Spraytight
		X	Explosion proof
		S	Submersible - 15 foot
		D	Drip-proof
6 (figure)	Maximum ambient	5	50°C
	temperature	6	65°C
		8	80°C
7 (letters -vane-axial tube-axial)	Nonmagnetic construction of fan and motor	NM	(This seventh symbol is omitted unless applicable)
(letters -	Rotation (viewed	C W	Clockwise
centrifugal)	from drive side)	C C W	Counterclockwise
8 (letters - centrifugal)	Construction	NM	Nonmagnetic (this symbol is omitted unless applicable)
		NS	Non-sparking
		WT	Watertight
		AR	Acid resisting paint on air handling parts

Table 5-5 Navy standard fan motor designation

The following examples are provided to assist in use and interpretation of the aforementioned code.

1. A2A4W6-NM. This designation indicates:
   A = Vaneaxial fan
   2 = Nominal airflow rate is 2000 CFM (Figure 5-1)
   A = AC is required
   4 = 440-volt 3-phase 60Hz AC
   W = Motor enclosure is spraytight
   6 = Maximum ambient temperature is 65°C
   NM = Nonmagnetic construction of fan and motor
   NS = Non-sparking motor

2. C5A4W5 CW-NS. This designation indicates:
   C = Centrifugal fan
   5 = Airflow rate is 5000 CFM (Figure 5-3)
   A = AC is required
   4 = 440-volt 3-phase 60-Hz AC
   W = Spraytight motor enclosure
   5 = Maximum ambient temperature is 50°C
   CW = Rotation clockwise (viewed from drive drive side)

5-6 FAN MAINTENANCE PROCEDURES

5-6a PMS requirements for fans

The PMS requirements for Navy Standard Fans are shown in Table 5-6.

5-6b Non-PMS requirements for fans

PMS does not presently cover the fan casing, but it does require periodic inspection and cleaning. The casing is very rugged and can be scraped if the dirt is caked on. The impeller or blade, on the other hand, is balanced and great care must be taken when cleaning. A rag with a liquid cleaner is the only thing to use on the fan blade.

Item	Type of System	MIP	Control Number	Requirement
Fan housing	All	6641/5	X51H	Annual
and impeller				
Lubricate	All	6641/5	X49C	Annual
fan/blower				
shaft bearings				
Fan/blower	All	6641/5	W71N	18M-3
resilient mounts				

Table 5-6 PMS Requirements for Fans

Chapter

6

VI - FAN MOTOR CONTROLLERS

General knowledge of HVAC fan controllers.

6-1 INTRODUCTION

There are basically three types of fan motor controllers: 1) LVRE, 2) LVP & 3) LVR.

6-1a LVRE (Low Voltage Release Effect)

The LVRE controllers are shown in Figure 6-1 and Table 6-1. In this controller, when the power is secured, whether intentionally or inadvertently, the fan will secure. When the power is restored, the fan will restart automatically.

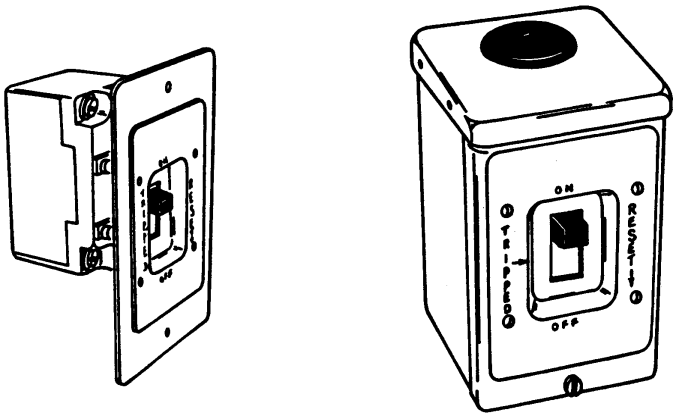


Figure 6-1 LVRE Controller

PHYSICAL DATA													ORDERING DATA	
SIZE	MFG ID 5134	VOLT RATE	HP RATE	CONT L/R	PROTECTION CPF	PROTECTION LVP	PROTECTION LVR	PROTECTION OLP	ENCL TYPE	DIMENSIONS ENCL SIZE W	DIMENSIONS ENCL SIZE H	DIMENSIONS ENCL SIZE D	COG	NSN 6110-00
0	938G3	440	3/15A	L			X	X		3 1/4	6	3 3/4	9G	635-7128
0	938G4	440	2/15A	L			X	X	DP	3 1/2	6 1/8	3 1/2	1H	827-7122

Table 6-1 LVRE Controller

6-1b LVP (Low Voltage Protection).

Within the LVP type, there are two kinds, a one-speed and a two speed. The LVP controllers are shown on Tables 6-2 and 6-3. Low voltage (or under voltage) protection is the feature which provides for disconnecting the motor from the power supply upon reduction or loss of voltage, and keeping it disconnected after voltage returns, until the operator restarts the motor. To make the fan run again you must manually close the contacts by pushing the start push button.

PHYSICAL DATA										ORDERING DATA	
	MFG ID	VOLT	HP	CONT	PROTECTION				ENCL		NSN
SIZE	6962	RATE	RATE	L/R	CPF	LVP	LVR	OLP	TYPE	COG	6110-00
0	H151A8	440	5	R	X	X		X	DP	9G	899-0059
0	ED1220A2	440	5	R	X	X		X	DP	9G	991-0711
1	H103A	440	10	L		X		X	DP	9G	929-1217
1	ED854	440	10	L	X		X	X	DP	7H	683-0494
1	H59A	440	10	L			X	X	DP	9G	810-9810
1	ED1222A3	440		L	X	X		X	DP	1H	991-0713
1	ED1222A2	440	27A	L	X	X		X	DP	1H	991-0712
1	ED1301A2	440	27A	R	X	X		X	DP	1H	991-0716
1	ED1557A2	440	10	R	X	X		X	DP	1H	134-8452
1	H55A1	440	10	L/R	X	X		X	DP	9G	914-3171
1	CD578	440	7.5	L/R	X		X	X	DP	9G	694-9580
1	22M2	440	7.5	R	X	X		X	DP	1H	635-7051
1	ED15110A2	440	10	R	X	X		X	DP	9G	045-3092
1	ED924	440	10	L			X	X	DP	9G	958-3794
1	ED1219A2	440	10	R	X	X		X	DP	9G	991-0710
1	ED1225A2	440	10	R	X	X		X	DP	7H	991-0714
1	ED1309A2	440		R	X		X	X	DP	1H	828-1820
2	ED161A2	440	25	R	X		X	X	WT	7H	913-6473
2	H109A2	440	25	R	X		X	X	WT	7H	914-2222
2	ED1357A2-NM2	440	25	L		X		X	DP	9G	950-1672
2	ED3942	440	25	L	X	X		X	DP	9G	212-9130
2	ED1412A2	440	25	L		X		X	DP	1H	957-3938
2	ED229	440	25	R	X	X		X	DP	1H	255-0914
2	ED6352	440	25	L/R	X	X		X	WT	1H	553-0621
2	ED1526A2	440	25	R	X	X		X	EP	7H	702-7364
2	ED635-1	440	25	R	X	X		X	WY	1H	553-0620

Table 6-2 Single Speed LVP Controller

	MFR ID	VOLT	HP	CONT	PROTECTION						ORDERING DATA
SIZE	6967	RATE	RATE	L/R	CPF	LVP	LVR	OLP	TYPE	COG	6110-00
0	ED248A2	440	5	L	X	X		X	DP	7H	991-0717
1	ED18A2	440	10	L	X	X		X	DP	9G	843-8336
1	H1358A2	440	10	R	X	X		X	DP	9G	819-0574
1	ED105A2	440	7.5	R	X	X		X	ST	7H	500-4669
1	ED106A2	440	10	L	X	X		X	DP	7H	769-5393
1	ED107A2	440	10	L	X		X	X	DP	9G	913-5958
1	ED43A2	440	10	L		X		X	WT	7H	972-9940
2	ED216A2	440	25	L			X	X	DP	9G	168-3733
2	ED68A2	440	25	R			X	X	DP	7H	071-8351
2	H18A2	440	25	L/R	X	X			DP	9G	839-2654
2	ED17A2	440	25	R	X	X		X	DP	3H	997-0109
2	ED232A2	440	25	L	X	X		X	DP	9G	669-8998

Table 6-3 Two Speed LVP Controller

6-1c LVR (Low Voltage Release)

The LVR controllers are shown on Table 6-4. Low voltage release is obtainable only in magnetic controllers. Upon reduction or loss of voltage, the operating coil is de-energized and the main contactor opens. When power is restored, the operating coil is energized again and the motor restarts automatically.

PHYSICAL DATA											ORDERING DATA
	MFG ID	VOLT	HP	CONT	PROTECTION				ENCL		NSN
SIZE	6922	RATE	RATE	L/R	CPF	LVP	LVR	OLP	TYPE	COG	6110-00-
0	H37	110 440	.5/ 7.5	L				X	ST WT	9G	632-6078
1	ED42NM	110 440	7.5/ 1.3A	L		X		X	WT	9G	809-1401
1	H36E	440	7.5	L			X	X	DP	9G	236-1632
1	H37C	110 440	7.5/ 3.2A	L			X	X	ST	1H	950-6065

Table 6-4 LVR Controller

6-2 CONTROLLER IDENTIFICATION AND LOCATION

6-2a Controller Nameplates

There are a number of requirements for nameplates for fan controllers.

6-2a.1 The main tag should show the fan number as well as type of system.

W	**EXHAUST** **1-23-6**

6-2a.2 The second tag should show electrical information.

E-1-116-3
(2-142-1)-1P-C1B2
FED FROM PP 2-142-1

6-2a.3 The third tag should show fan classification.

W

6-2a.4 An additional tag should show the spaces served.

E-03-108-1
SERVES

01-102-1-L	**01-104-3-Q**
02-106-1-L	**03-100-1-Q**
03-100-3-Q	**03-100-5-Q**
03-110-1-L	

6-2a.5 If the fan has special requirements, then a tag with any special instruction or warning should be attached.

WARNING

THIS CONTROLLER HAS MORE THAN ONE POWER SOURCE.

WARNING

SECURING FAN WILL SET OFF ALARM. CALL CENTRAL CONTROL BEFORE SECURING.

6-2b Controller location

The basic requirement is to locate the fan controller near the fan except when the fan serves only one space. When a fan serves only one space, the controller will be located in or near the space served. On an aircraft carrier, these requirements can cause some confusion (e.g., the exhaust fans that serve the second deck heads are located on the 01 and 02 Levels and so the controllers are also located there). To find the controller for each space, first you must know the system number and then you can locate the fan controller by using the Damage Control Book, Volume Two, Fan List (refer to Table 3-1). This book will be found in Damage Control Central and additional copies should be available in the Engineering Department. Refer to Table 6-5 for vent controller PMS Maintenance Schedule and Tables 6-6 thru 6-8 identifies various relay heater coils.

Item	Type of System	MIP	Control Number	Requirement
Controller	All	3001/2	See MIP	See MIP

Table 6-5 Ventilation Controller PMS Maintenance Schedule

Motor Ampere Rating Min - Max	Number Stamped On Coil	NSN 5999-00
0.817 – 0.866	9104H3915	503-1975
0.867 – 0.941	9104H3916	503-1975
0.942 – 1.01	9104H3917	503-1998
1.02 – 1.10	9104H3918	538-1290
1.11 – 1.17	9104H3919	503-1997
1.18 – 1.28	9104H3920	621-5748
1.29 – 1.39	9104H3921	538-1291
1.40 – 1.51	9104H3922	504-9618
1.52 – 1.60	9104H3923	504-7985
1.61 – 1.75	9104H3924	503-1968
1.76 – 1.88	9104H3925	503-1967
1.89 – 2.05	9104H3926	504-9617
2.06 – 2.21	9104H3927	504-9307
2.22 – 2.38	9104H3928	504-9308

Table 6-6 Overload Relay Heater Coils for Size 1 Enclosed Controllers

Motor Ampere Rating Min - Max	Number Stamped On Coil	NSN
4.75 – 5.14	9104H3938	504-9428
5.15 – 5.56	9104H3939	504-9166
5.57 – 6.04	9104H3940	504-9527
6.05 – 6.51	9104H3941	504-7994
6.52 – 6.99	9104H3942	504-7996
7.00 – 7.55	9104H3943	504-9771
7.56 – 8.15	9104H3944	504-9432
8.16 – 8.74	9104H3945	504-9440
8.75 – 9.57	9104H3946	538-1032

Table 6-7 Overload Relay Heater Coils For Size 2 Enclosed Controllers

Motor Ampere Rating Min - Max	Number Stamped On Coil	NSN 5999-00 *4540-00
0.35 – 0.38	81D303	504-9647
0.39 – 0.42	81D304	504-7724
0.43 – 0.46	81D305	504-7862
0.47 – 0.50	81D306	504-7863
0.51 – 0.56	81D307	503-1614
0.57 – 0.62	81D308	503-1615
0.63 – 0.67	81D309	306-5524
0.68 – 0.74	81D310	503-1616
0.75 – 0.82	81D311	504-9297
0.83 – 0.90	81D312	503-1617
0.91 – 0.99	81D313	653-1677
1.00 – 1.09	81D314	504-9732
1.10 – 1.20	81D315	383-2109
1.21 – 1.31	81D316	504-7934
1.32 – 1.44	81D317	504-7906
1.45 – 1.59	81D318	504-7886
1.60 – 1.74	81D319	504-7888
1.75 – 1.92	81D320	504-7889
1.93 – 2.11	81D321	504-7916
2.12 – 2.31	81D322	324-8061
2.32 – 2.55	81D323	504-7929
2.56 – 2.80	81D324	504-7930
2.81 – 3.09	81D325	504-7861
3.10 – 3.42	81D326	504-7927
3.43 – 3.75	81D327	*142-2640

Table 6-8 General Electric Relay Heater Coils (continued on next page)

Motor Ampere Rating Min - Max	Number Stamped On Coil	NSN
3.76 – 4.10	81D328	504-7988
4.11 – 4.54	81D329	992-7182
4.55 – 4.98	81D330	504-7986
4.99 – 5.45	81D331	*377-6410
5.46 – 6.03	81D332	504-9249
6.04 – 6.65	81D333	504-9250
6.66 – 7.25	81D334	504-9252
7.56 – 8.05	81D335	541-4727
8.06 – 8.83	81D336	538-1098
8.84 – 9.70	81D337	503-1594
9.71 – 10.6	81D338	383-2253
10.7 – 11.7	81D339	504-7925
11.8 – 12.7	81D340	504-7926
12.8 – 13.9	81D341	503-1595
14.0 – 15.2	81D342	383-2290
15.3 – 16.8	81D343	504-7890
16.9 – 18.5	81D344	504-9219
18.6 – 20.6	81D345	383-2312

Table 6-8 General Electric Relay Heater Coils (continued)

Chapter

7

VII - NAVY STANDARD VENTILATION HEATERS

General knowledge of HVAC steam and electric heaters.

7-1 INTRODUCTION

Ventilation heaters, convection heaters, unit heaters, and electrical heaters accomplish the heating of ships. Ventilation heaters are installed within the ventilation ducts and trunks. They are the preferred types where compartments are mechanically ventilated because of the saving in weight, space, and piping when compared with other types of heating. On supply systems a pre-heater is located near the weather air intake which provides enough heat to prevent condensation on the ventilation ducts, refer to Figures 2-1 and 7-1. This air is passed through zone reheaters which raise the temperature of the air as desired for proper heating of the space, or spaces, served. The supply and recirculation systems both use reheaters refer to Figures 2-1, 2-2, and 7-1. Each zone is provided with a reheater. Spaces that require heat and are not equipped with mechanical supply ventilation are heated with convection heaters. Unit heaters are used in large compartments where the amount of supply ventilation is too small to provide sufficient heat through ventilation heaters or where there is no ventilation supply and the heat requirements exceed the capacity of convection heaters. Electric heaters are used on surface ships in spaces located a considerable distance from steam lines or where steam lines are not permitted.

7-1a Ventilation Heaters

There are two types of Navy Standard Duct Type Ventilation Steam Heaters. Type "S" has a serpentine-type coil and is furnished in sizes 21 to 25, refer to Figure 7-2 and Table 7-2. Type "T" has double tubing to prevent freezing and is furnished in sizes 26 to 39, refer to Figure 7-3 and Table 7-3. These each have three different fin spacing and are specified in the design process according to the heating requirements:

7-1a.1 L = 36 fins per foot or 3 fins per inch (low temperature differential required).

7-1a.2 M = 60 fins per foot or 5 fins per inch (moderate temperature differential required).

7-1a.3 H = 90 fins per foot or 7-1/2 fins per inch (high temperature differential required).

Ventilation heaters ordinarily operate on a steam pressure of 35 psig; however, hot water (180-212°F, 92-100°C) or steam (0 psig to 100 psig) may be used.

7-1b Convection Heaters

Navy Standard Convection Heaters are installed in spaces that have no mechanical supply ventilation. They are normally used at a steam pressure of 35 psig, but can be used with hot water, or steam to 150 psig. Adjusting the air damper controls heating of the compartment. When fully closed, the damper shuts off the induced air opening. Navy Standard Convection heaters are shown on Figure 7-4 and Table 7-4. The heaters are furnished with a steel housing and will not operate properly with the housing removed.

7-1c Unit Heaters

Navy Standard Unit Heaters are equipped with a fan, thermostatic control valve, strainer, and trap. The heater fans are interchangeable with standard Navy propeller fans, except that they have special housing and bracket assemblies. Unit heaters are normally used at a steam pressure of 35 psig but may be subject to 150 psig. Heat controls are interchangeable with standard Navy temperature regulators. Unit heaters are shown on Figure 7-5 and Table 7-5.

7-1d Electric Navy Standard Duct Type Heaters

Navy Standard Electric Heaters are available in twenty sizes, 19 through 38, in three types, for a total of fifty-seven heater capacities (sizes 19 and 20 are not available in all types), refer to Figure 7-6 and Table 7-6. Heaters consist of three or more electrical heating elements made of a helical coiled resistance wire centered in a densely packed insulating material and enclosed in a hermetically sealed finned metal sheath. A threaded stud type terminal is provided at each end of the element.

Electrical power characteristics are as follows:

- 115 volts, 60 hertz, 3 phase for size 19 through 21 and size 22 type L.

- 440 volts, 60 hertz, 3 phase for size 22 types M and H, and sizes 23 through 38.

The enclosure for the electrical connections on the side of the heater casing is of spray tight construction and the heating element entrance to the enclosure is watertight. Heaters are of standard construction unless specified to be non-magnetic.

7-1e Development of an Equipment Guide List for Heaters

The Vent Shop (see Chapter 1) shall obtain a copy of VENTILATION LIST OF DUCT TYPE HEATERS AND TEMPERATURE REGULATORS (Steam and Electric) and a copy of the ship's Zone Inspection List. Look at the Heater List, start with Heater Number Item 1 and locate the heater number i.e., 01-233-2, then go to the compartment number where the heater is located, i.e. 01-231-2-L. Now with this information in hand look at the Zone Inspection List and find the compartment 01-231-2-L, and the work center which owns the compartment, i.e., XX01, or SS05. In this fashion the Equipment Guide List (EGL) can be prepared for each division.

7-1f Heater maintenance procedures

The PMS requirements for heaters can be found in Table 7-1. They are taken from the Maintenance Index Page 6641/5.

PMS REQUIREMENTS FOR HEATERS

Item	Type of System	MIP	Control Number	Requirement
Pre-heater	Supply	6641/5	W31H	Quarterly
Reheater	Supply Recirc	6641/5	W31W	Annual
Steam/				
Electric				
Combination	Supply	6641/5	W32N	Annual
Pre-heater/				
Reheater				
Steam		6641/5	W32G	Annual
Convection				
Unit Heaters		6641/5	W31U	Annual

Table 7-1 PMS Requirements for Heaters

NOTE: All of the above MRCs recommend an Equipment Guide List (EGL). On an aircraft carrier, this is the only way to ensure complete PMS coverage on all heaters.

STEAM SYSTEM FOR PRE-HEATER IN VENTILATION SYSTEM

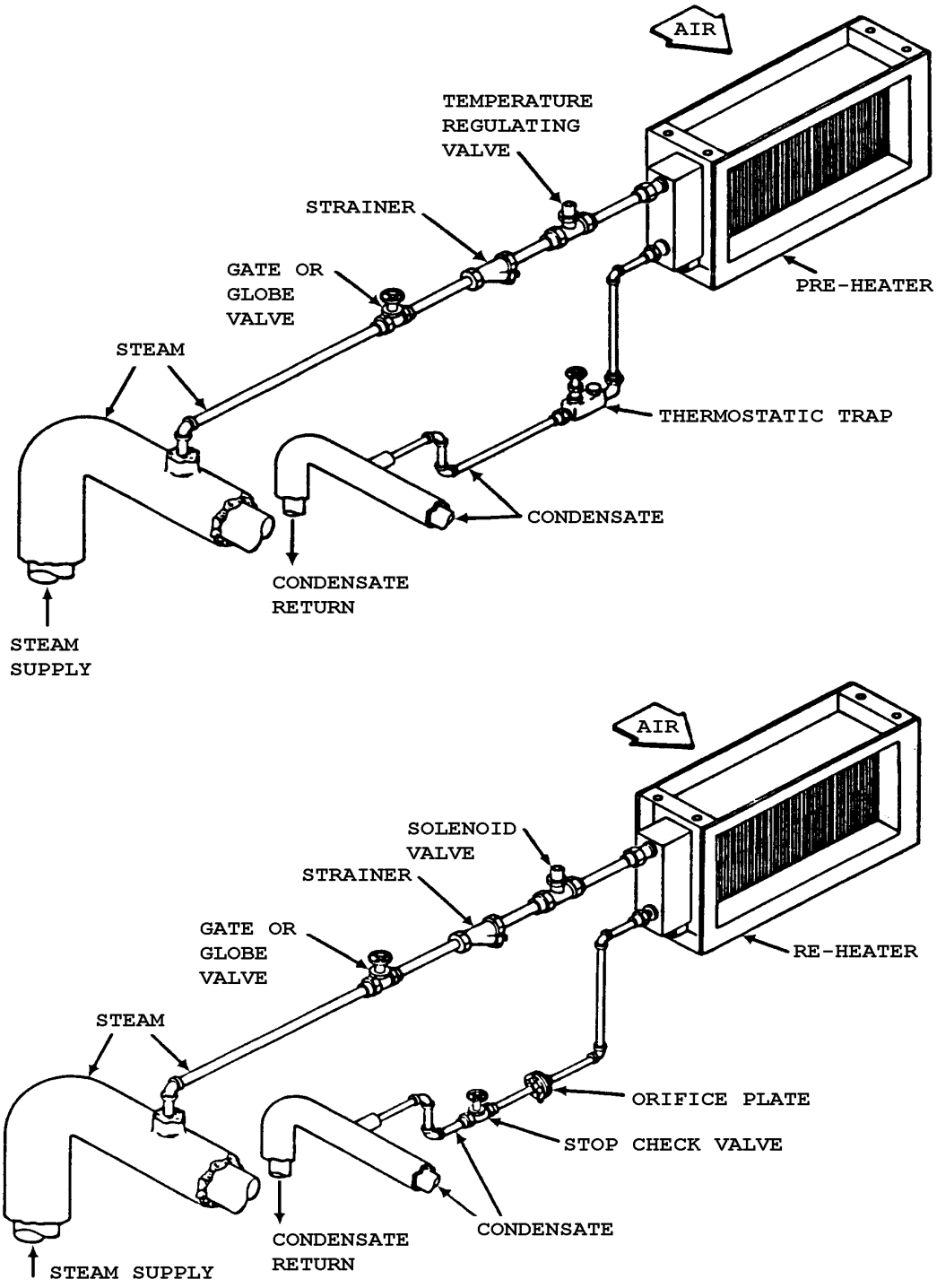


Figure 7-1 Steam system for pre-heater in ventilation system

TYPE “S” STEAM HEATER

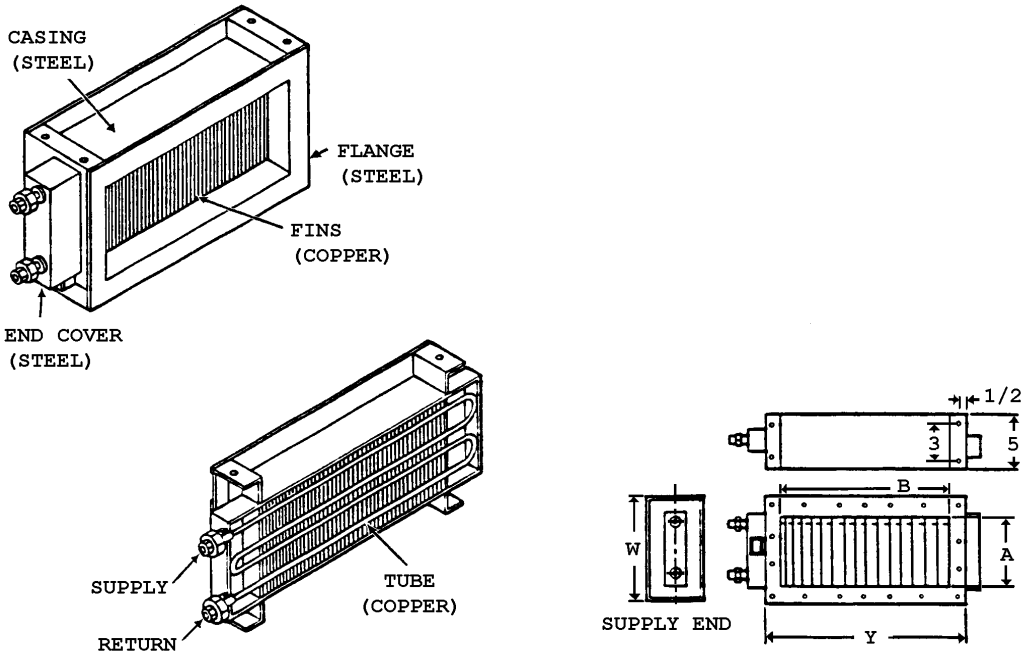


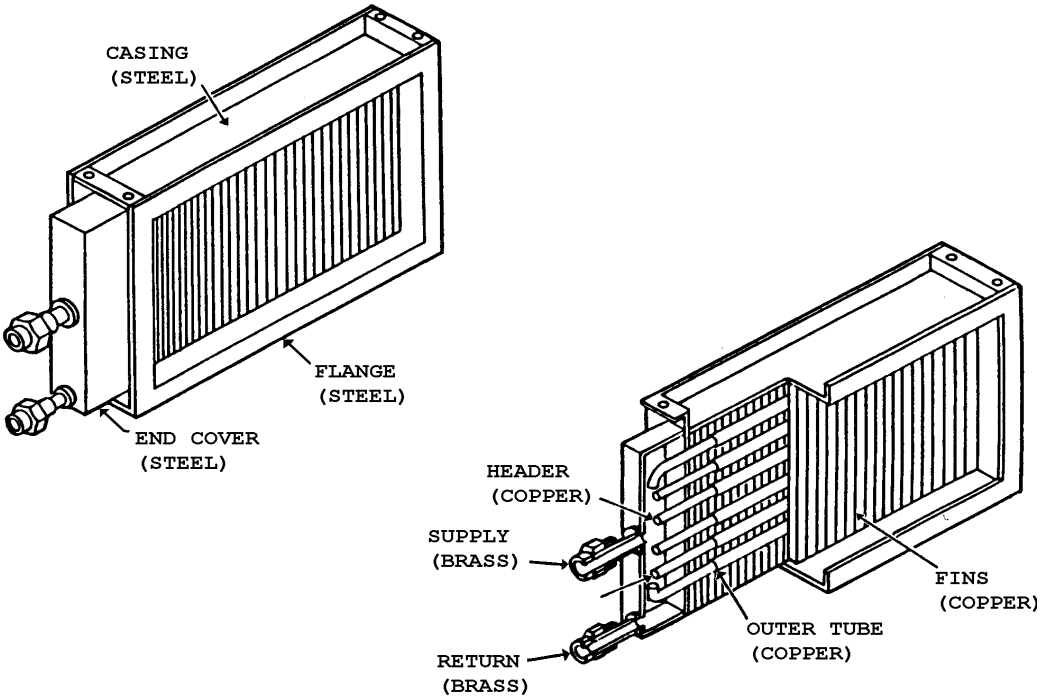
Figure 7-2 Steam Heater Type “S”

PHYSICAL DATA													ORDERING DATA		
HTR	CONDENSATE LBS/HR ENTERING FINS AT 600 FPM SPACING			DIMENSIONS (INCHES) FIXED				APPROX WEIGHT POUNDS			CONNs IPS NORMAL				NSN
NO.	H	M	L	W	Y	A	B	H	M	L	SPLY	RTN	TYPE	COG	4520-00
21	6.3	4.2	2.7	6 ¼	9	3 ¼	6	10	10	9	½	½	L	9C	273-1060
													M	9C	273-1061
													H	9C	273-1062
22	9.5	6.4	4.1	6 ¼	12	3 ¼	9	11	10	10	½	½	L	9C	273-1063
													M	9C	273-1064
													H	9C	273-1065
23	14.7	9.9	6.4	6 ¼	17	3 ¼	14	13	12	12	½	½	L	9C	273-1066
													M	9C	273-1067
													H	9C	132-5605
24	18.1	12.2	7.9	9 ¼	12	6 ¼	9	14	13	12	½	½	L	9C	273-1068

Table 7-2 Steam Heater Type “S” (continued on next page)

													M	9C	132-5604
													H	9C	273-1069
25	28.2	19	12.1	9 ¼	17	6 ¼	14	21	19	18	½	1/2	L	9C	273-1070
													M	9C	132-5603
													H	9C	273-1071

Table 7-2 Steam Heater Type "S"(continued)



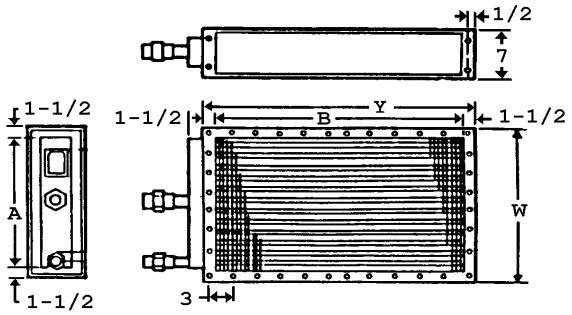


Figure 7-3 Steam Heater Type "T"

PHYSICAL DATA													ORDERING DATA		
HTR	CONDENSATE LBS/HR ENTERING FINS AT 600 FPM SPACING			DIMENSIONS (INCHES) FIXED				APPROX WEIGHT POUNDS			CONNs IPS NORMAL				NSN
NO.	H	M	L	W	Y	A	B	H	M	L	SPLY	RTN	TYPE	COG	4520-00
26	44.4	29.8	19.2	9 1/4	25	6 1/4	22	40	38	35	3/4	1/2	L	9C	273-1251
													M	9C	273-1252
													H	9C	273-1253
27	65.6	44.1	28.4	12 1/4	25	9 1/4	22	48	45	42	3/4	1/2	L	1H	273-1254
													M	9C	273-1255
													H	9C	273-1256
28	90	60.5	39	12 1/4	33	9 1/4	30	60	55	51	1/2	3/4	L	9C	273-1257
													M	9C	273-1258
													H	9C	273-1259
29	119	80	51.5	15 1/4	33	12 1/4	30	72	65	59	1/2	3/4	L	9C	273-1260
													M	9C	273-1261
													H	9C	273-1262
30	148	99.5	64.1	18 1/4	33	15 1/4	30	83	74	67	1 1/4	1/2	L	9C	273-1263
													M	9C	273-1264
													H	9C	273-1265
31	166	111	71.9	15 1/4	45	12 1/4	42	88	79	72	1 1/4	1/2	L	9C	273-8362
													M	9C	273-1266
													H	9C	273-1267
32	177	119	76.5	21 1/4	33	18 1/4	30	94	84	76	1 1/4	1/2	L	9C	273-1268
													M	9C	273-1269
													H	9C	273-1270
33	288	153	98.7	19 1/4	45	16 1/4	42	114	101	90	1 1/4	1/2	L	9C	273-1271
													M	1H	273-1272
													H	9C	273-1273
34	276	185	120	18 3/4	59	15 1/4	56	133	117	104	1 1/2	1 1/4	L	9C	273-1274
													M	9C	273-1275
													H	1H	273-8363
35	329	221	143	27 1/4	45	24 1/4	42	153	132	116	1 1/2	1 1/4	L	9C	273-8364
													M	9C	273-8365
													H	9C	273-1276
36	384	258	167	24 1/4	59	21 1/4	56	171	147	128	1 1/2	1 1/4	L	9C	273-1277
													M	1H	273-1278
													H	9C	273-1279
37	492	331	213	39 1/4	45	36 1/4	42	200	178	153	1 1/2	1 1/4	L	9C	273-1280
													M	1H	273-1281
													H	9C	273-1282
38	600	403	260	36 1/4	59	33 1/4	56	245	208	178	1 1/2	1 1/4	L	9C	
													M	9C	273-1284
													H	9C	273-1285

Table 7-3 Steam Heater Type "T"

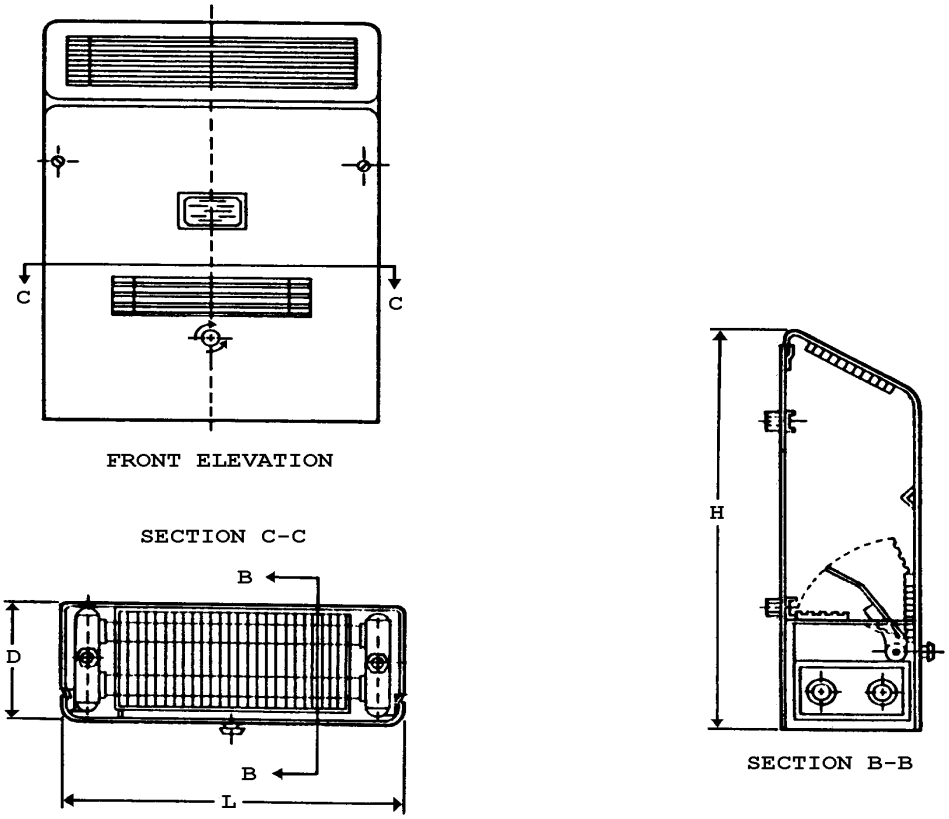


Figure 7-4 Navy Standard Convection Heater

PHYSICAL DATA					ORDERING DATA	
SIZE NO.	DIMENSIONS (INCHES) L	H	D	NET WEIGHT (LBS)	COG	NSN 4520-00
1 1/2	9	20	4	18	9C	271-9902
2	10 1/2	20	4	19	9C	271-9901
2 1/2	12	20	4	20	9C	288-7111
3 1/2	12	20	6	24	9C	273-1127
4 1/2	15	20	6	28	9C	273-1150
6	19	26	6	33	9C	273-1126
8	23	26	6	46	9C	273-1128
11	29	26	6	56	9C	273-1129
15	36	30	6	73	9C	273-1152
20	48	30	6	100	9C	273-1153

Table 7-4 Convection Heater

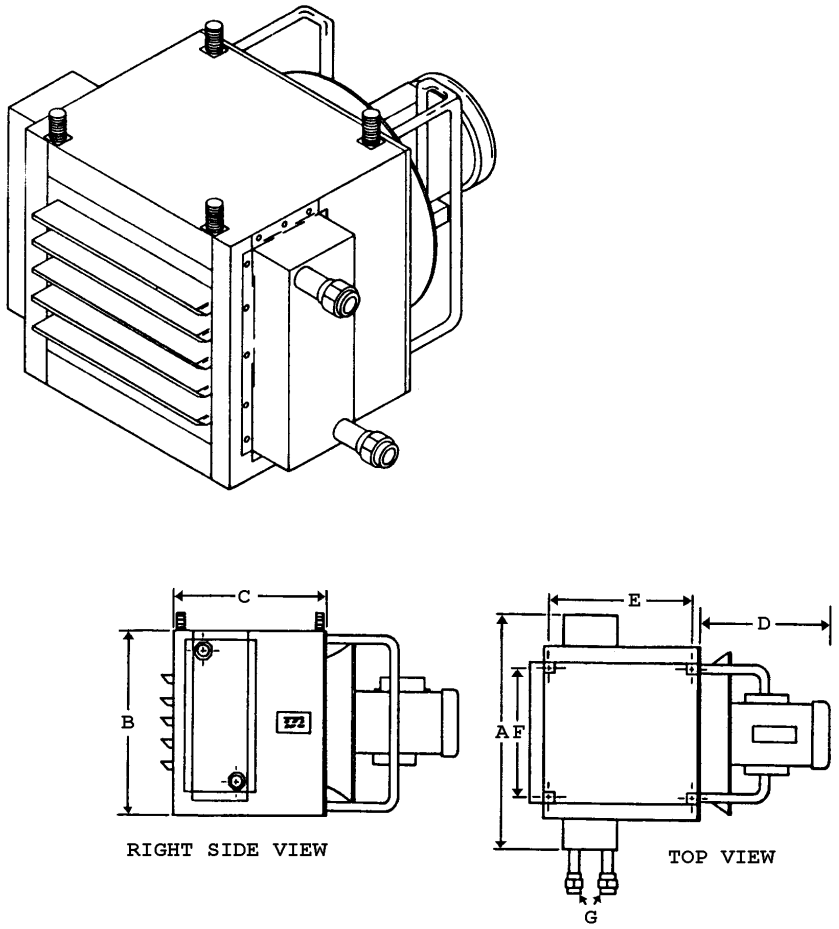
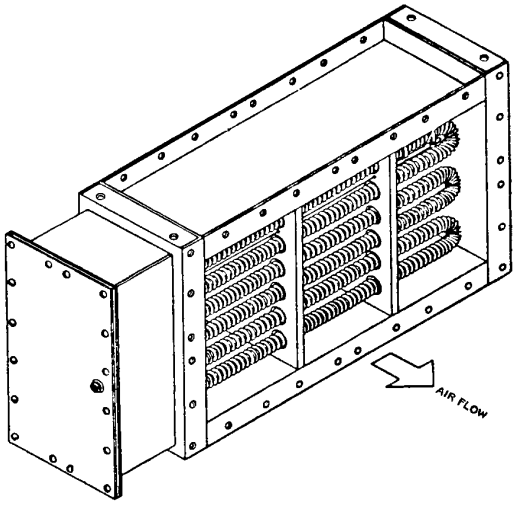
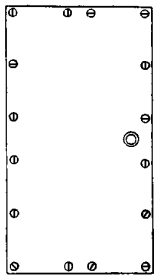


Figure 7-5 Unit Heater

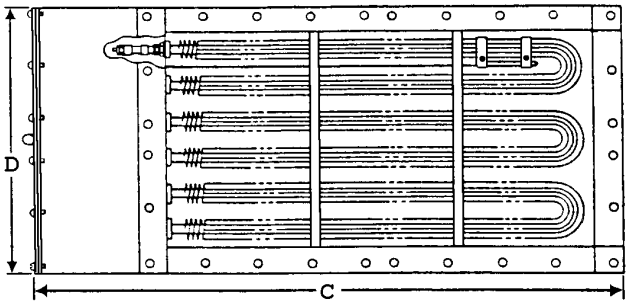
PHYSICAL DATA								ORDERING DATA	
IPS SIZE NO.	DIMENSIONS				FIXED DIMENSION		PIPE CONN IPS		
	A	B	C	D	E	F	G	COG	NSN 4520-00
11	20	14	14	13	12 3/4	10	3/4	9C	498-4170
12	22	17	14	13	12 3/4	12	3/4	9C	498-4173
13	25	20	14	14	12 3/4	15	3/4	9C	498-4175
14	31	23	14	14	12 3/4	19	1 1/4	9C	498-4177
15	25	24	14	15	12 3/4	15	1 1/4	9C	498-4179

Table 7-5 Unit Heater

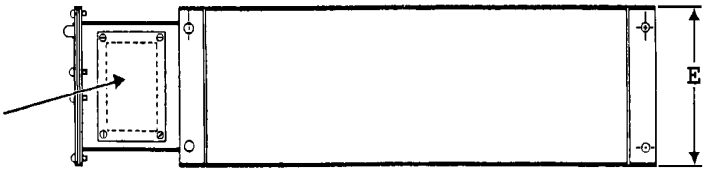




END VIEW



ELEVATION VIEW DISCHARGE SIDE



BOTTOM VIEW

Figure 7-6 Electric Heater

PHYSICAL DATA				ORDERING DATA				
SIZE	DIMENSIONS (INCHES)							NSN
EH	C	D	E	TYPE	MODEL	APL	COG	4520-01
19	13	6 1/4	6	H	106-056816-001	74001150	9C	222-3645
20	13	6 1/4	6	M	106-056816-002	74001134	9C	212-7552
				H	106-056816-003	74001140	9C	203-1101
21	13	6 1/4	6	L	106-056816-004	74001135	9C	199-6507
				M	106-056816-005	74001160	9C	134-3502
				H	106-056816-006	74001128	9C	212-7550
22	16	6 1/4	6	L	106-056816-007	74001136	9C	357-4144
				M	106-056816-008	74001127	9C	212-7551
				H	106-056816-009	74001131	9C	198-0737
23	20	6 1/4	6	L	106-056816-010	74001132	9C	178-6456
				M	106-056816-011	74001156	9C	191-3973
				H	106-056816-012	74001168	9C	183-4535
24	15	9 1/4	6	L	106-056816-013	74001133	9C	192-1442
				M	106-056816-014	74001130	9C	151-3295
				H	106-056816-015	74001151	9C	135-0114
25	20	9 1/4	6	L	106-056816-016	74001141	9C	151-3296
				M	106-056816-017	74001153	9C	195-4315
				H	106-056816-018	74001142	9C	200-0681
26	29	9 1/4	8	L	106-056816-019	74001154	9C	184-4070
				M	106-056816-020	74001138	9C	088-4440
				H	106-056816-021	74001162	9C	357-4143
27	29	12 1/4	8	L	106-056816-022	74001148	9C	186-2217
				M	106-056816-023	74001147	9C	212-7549
				H	106-056816-024	74001136	9C	148-9352
28	38	12 1/4	8	L	106-056816-025	74001137	9C	200-0680
				M	106-056816-026	74001217	9C	153-9295
				H	106-056816-027	74001234	9C	150-5403
29	38	15 1/4	8	L	106-056816-028	74001152	9C	154-8042
				M	106-056816-029	74001157	9C	298-5221
				H	106-056816-030	74001233	9C	151-9783
30	39	18 1/4	8	L	106-056816-031	74001159	9C	117-9441
				M			9C	236-0452
				H	106-056816-033	74001284	9C	219-1269
31	51	15 1/4	8	L	106-056816-034	74001229	9C	150-0843
				M			9C	259-5766
				H			9C	250-7081

Table 7-6 Electric Heater

Chapter

8

VIII - COOLING COILS

General knowledge of HVAC cooling coils.

8-1 INTRODUCTION

The mechanical cooling system has been designed to maintain an effective temperature within the spaces cooled of approximately 80 degrees F. Effective temperature is an arbitrary index number whose value depends on three factors: dry bulb temperature, relative humidity, and velocity of air movement within the space. The design value of the effective temperature may vary in some spaces due to the nature of the work being performed and the number of personnel engaged at the time.

8-2 Mechanical Cooling System Major Components

Mechanical cooling systems consist of five major arrangements 1) Duct Cooling Coils; 2) Unit Coolers; 3) Fan Coil Assembly; 4) Fan Coil Units and 5) Gravity Cooling Coils:

8-2a Duct Cooling Coils

Duct-type cooling coils are installed in all recirculating systems. These coils are cooled by chilled water, refer to Figures 8-1 through 8-3.

8-2b Unit Coolers

Unit Coolers are self-contained air-conditioning systems. The cooling coil, fan, filters, and controls are complete in a compact unit. Unit coolers are used in the enclosed operating stations (EOS) of the main machinery room, switchboard rooms, and other small spaces where distribution ductwork is unnecessary. The Unit Coolers are cooled by chilled water, refer to Figures 8-4, 8-5 and Tables 8-4 & 8-7.

8-2c Fan Coil Assemblies

Fan coil assemblies (sectional and non sectional) consist of a fan and motor, a chilled water cooling coil, electrostatic precipitator (Sectional Type I only), air filters, internal bypass air damper, thermal insulation, and noise attenuation. The cabinet is designed to permit ready connection to a power source, drainage line, and chilled water supply and return lines. Supply and return ducts are connected to the upper portion of the assembly. The fan coil assembly draws air downward from the inlet, through the air filters, and across the electrostatic precipitator (Sectional Type I only). The air is then ducted into and through the chilled water

cooling coil, upward through the fan motor section, and discharged to the supply outlet, refer to Figure 8-6.

8-2c.1 Fan Coil Assembly. Fan Coil assemblies procured under Military Specifications MIL-A-23798 physical characteristics are given in Table 8-8. Each section of the assembly is no greater than 25 inches in height. Navy standard air filters in accordance with Military Specification MIL-F-16552 (see Chapter 9) are provided for filtering the air entering the assembly. The size and number of air filters are also shown in Table 8-8. Air filters for Type I assemblies are accessible and removable through a front access panel if specified when ordering. Fan Coil Assemblies (Sectional) are available in the following types:

- Type I - Three-section unit consisting of a cooling coil section, a fan motor section and an electrostatic precipitator section with power pack and air filters. See Figure 8-7.

- Type II - Three-section unit consisting of a cooling coil section, a fan motor section, and an air distribution plenum section with air filters. See Figure 8-8.

- Type III - Two-section unit consisting of a cooling coil section and a fan motor section with air filters. See Figure 8-9.

8-2c.2 Cooling Coil Section (Types I, II, and III). The cooling coil section is the base section of the fan coil assembly. The cooling coil section consists of a cooling coil and a condensate pan with a drain of not less than one inch in each end. The condensate drains are accessible without the removal of an access panel. The cooling coil is accessible and removable through the side panels. The removable side panels have features that permit left hand or right hand assembly of the cooling coil after delivery. The removable panels are flanged and have gaskets to be airtight.

8-2c.3 Fan Motor Section (Type I, II, and III). A fan motor section is mounted above the cooling coil section. The fan motor section consists of a centrifugal fan, fan drive, electric motor and internal air bypass damper around the cooling coil. The fan is accessible and removable through side panels. The removable side panels are flanged and are interchangeable on each section. There is access to the fan drive and the fan motor to adjust the pulley and the fan motor through a removable front panel. The front panel is flanged and has a gasket to be airtight. For Type II assemblies the air filters are generally located in the air distribution plenum section. In Type III assemblies, the air filter is located in the fan motor section.

8-2c.4 Electrostatic Precipitator Section (Type I). The top section contains the electrostatic precipitator in Type I assemblies. The electrostatic precipitator section consists of the electrostatic precipitator and power pack, air filters, and airflow connections. The ionizing, collection, and screen modules of the electrostatic precipitator are accessible and removable through a front access panel. The filters and electrostatic precipitator have separate access openings. The accesses are

flanged and gasketed to be airtight. The power pack is provided with a control panel and instruments, which can be located on either end of the section.

Note: COMNAVSEA MSG. 202141Z NOV 87: When ESP's become uneconomical to maintain, Ship's Force is authorized to remove and dispose of ESP internal components except from Medical/Dental spaces and Composite Material Repair Shops. Removals shall be documented under the 3M system. Existing Navy Standard Filters will be retained as sufficient filtration, and shall be maintained IAW Chapter 9.

8-2c.5 Fan Coil Assembly Non-Sectional. Fan coil assemblies procured prior to May 1973, under MIL-Spec MIL-A-23798, are one piece units containing a cooling coil, fan, and air filters. These early models, however, only came in one type, similar to a Type II sectional assembly. The assembly can be installed with or without ductwork. The air outlets are located on the top, front and ends of the cabinet, providing flexibility in the installation of the assembly. The components are designed similar to those of the sectional assembly. The non-sectional assemblies do not have the capability of incorporating an electrostatic precipitator. The capacity, requirements, and overall dimensions of the non-sectional assemblies are identical to those of the sectional assemblies. When these units become defective, they should be replaced with the sectional assembly. The sectional assemblies provide the capability of easier removal and routing through the ship.

8-2d Fan Coil Units

Fan coil units, like fan-coil assemblies, provide an alternative to recirculation systems using Navy Standard cooling coils and fans (built-up systems) for air conditioning aboard ships. Size, performance and external mounting designs and dimensions standardize the fan coil units. The fan coil unit was developed to provide an effective cooling system with a saving in space over built-up systems. Fan coil units are designed for horizontal mounting in the overhead, or vertical mounting on bulkheads, minimizing deck area required for installation. Fan coil units are generally located within the space served, or in an adjacent passage, reducing the requirement for fan rooms. The fan coil unit consists of a fan and a two-speed motor, motor controller, air filters, inlet and outlet grills, electric heater, heater contactor, thermal and acoustic insulation, thermostat, and a chilled water cooling coil. Ductwork may be connected to inlet and outlet openings. The cabinet is designed to permit ready connection of a power supply, chilled water supply and return lines, and drainage lines. The fan coil unit draws air from the inlet through the air filters, through the fan, into and through the cooling coil, through the heater, and discharges to the supply outlet, refer to Figures 8-10 and Tables 8-9 thru 8-12 for various fan coil unit types and classes.

8-2e Gravity Cooling Coils

Gravity cooling coils are used primarily in spaces where the load is small, such as magazines where cooling is required, and where electrical equipment would constitute a hazard. Navy standard gravity cooling coils are designed for overhead mounting, so that the drain connections are athwart ships. They are suspended a minimum of four inches below the insulated overhead, more if necessary to clear the overhead structure, and depend on convection currents to remove heat from the space. The gravity coil is available in three sizes, (1, 3, and 5), each size is capable of performing with either R-12 or chilled water as the

refrigerant. The letters GF and GW following the coil size, indicate the refrigerant used, GF for R-12, GW for chilled water.

8-3 COOLING COIL MAINTENANCE

Cooling coil scheduled maintenance requirements are shown in Table 8-1.

Item	Type of System	MIP	Control Number	Requirement
Cooling Coil	Recirc	6641/5	A8LG	Annual
Fan Coil Unit	Recirc	6641/5	B8XE	Annual
Fan Coil Assembly	Recirc	6641/5	X49C	Annual
Gravity Coil	-----	6641/5	W31Y	Annual

Table 8-1 PMS Requirements for Cooling Coils

8-4 COOLING COIL CLASSIFICATION

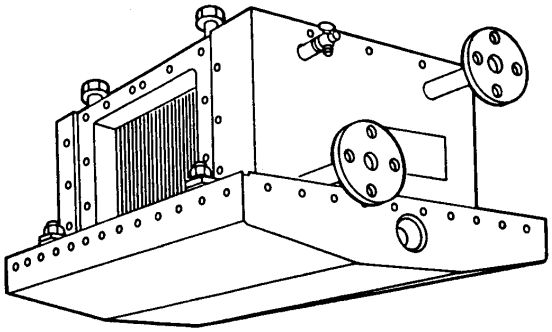
The navy coil classification code indicates the type of installation. The coils used in the Navy are classified GF, UF, DF, GW, UW, and DW, see Table 8-2. All cooling coils come with a nameplate attached, but sometimes they have been removed or painted over. Table 8-2 provides information to reorder a coil.

Note: Most series 40 coils have been replaced by series 50 or 60 series coils.

First Letter Code	Means	Uses
G	Gravity Flow	Areas where electrical equipment is not permitted (paint stowage, gasoline handling and pump stations, and ammunition magazines.
U	Unit Cooler	Where no ductwork is required (after steering and enclosed operating station).
D	Duct Type Coil	Where ductwork is required (berthing and offices).

Second letter Code	Means	Fluid
F	Direct Expansion	Refrigerant
W	Indirect Expansion	Chilled Water

Table 8-2 Classification Code



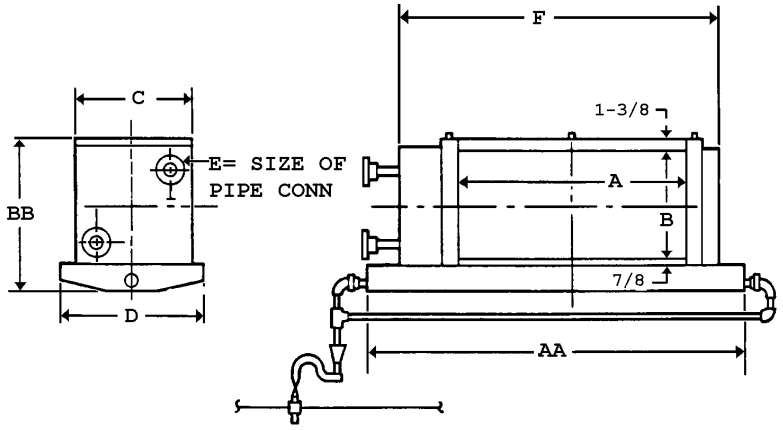


Figure 8-1 Cooling Coil series 40

PHYSICAL DATA								
COIL SIZE	DIMENSIONS (INCHES)						WEIGHT (LBS)	ORDERING DATA
	A	B	C	D	E	F		
41	11 3/4	7	15 3/4	21	3/4	21 3/4	160	FOR REPLACEMENT USE SERIES 60
42	14	9 1/4	15 3/4	21	3/4	24	200	
43	21	9 1/4	15 3/4	21	3/4	31	250	
44	25	11 1/2	15 3/4	21	1 1/4	35 3/4	300	
45	31 1/2	13 3/4	15 3/4	21	1 1/4	42 1/4	420	
46	39 1/2	18 1/4	15 3/4	21	1 1/4	50 1/4	640	
47	31 1/2	28 1/4	17 5/8	24 1/2	2	-	1000	
48	39 1/2	37 1/4	17 5/8	24 1/2	2	-	1300	

Table 8-3 Cooling Coil 40 Series

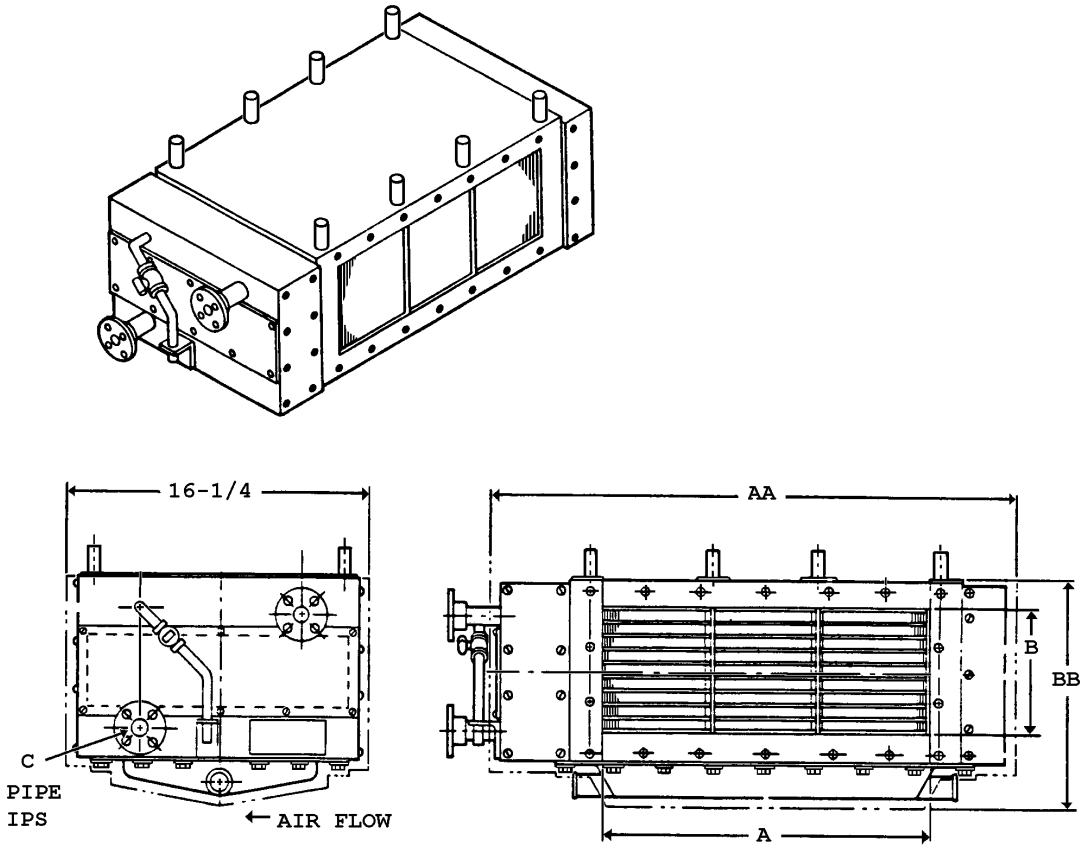


Figure 8-2 Cooling Coil Series 50

PHYSICAL DATA								
COIL SIZE	FACE AREA SQ FT	DIMENSIONS (INCHES) A	B	C	ESTIMATED WEIGHT (LBS)	MAX OVERALL DIMENSIONS AA	BB	ORDERING DATA
51	0.57	11 3/4	7	3/4	145	23	12 3/4	
52	0.9	14	9 1/4	3/4	185	25 1/4	15	FOR
53	1.35	21	9 1/4	3/4	230	32 1/4	15	REPLACEMENT
54	2	25	11 1/2	1 1/4	270	37	17 1/4	USE
55	3	31 1/2	13 3/4	1 1/4	400	43 1/2	19 1/2	SERIES 60
56	5	39 1/2	18 1/4	1 1/4	615	51 1/2	24	
57	7.5	39 1/2	28 7/16	2	975	51 3/4	34 7/8	
58	10	39 1/2	37 7/16	2	1225	51 3/4	43 7/8	

Table 8-4 Cooling Coil Series 50

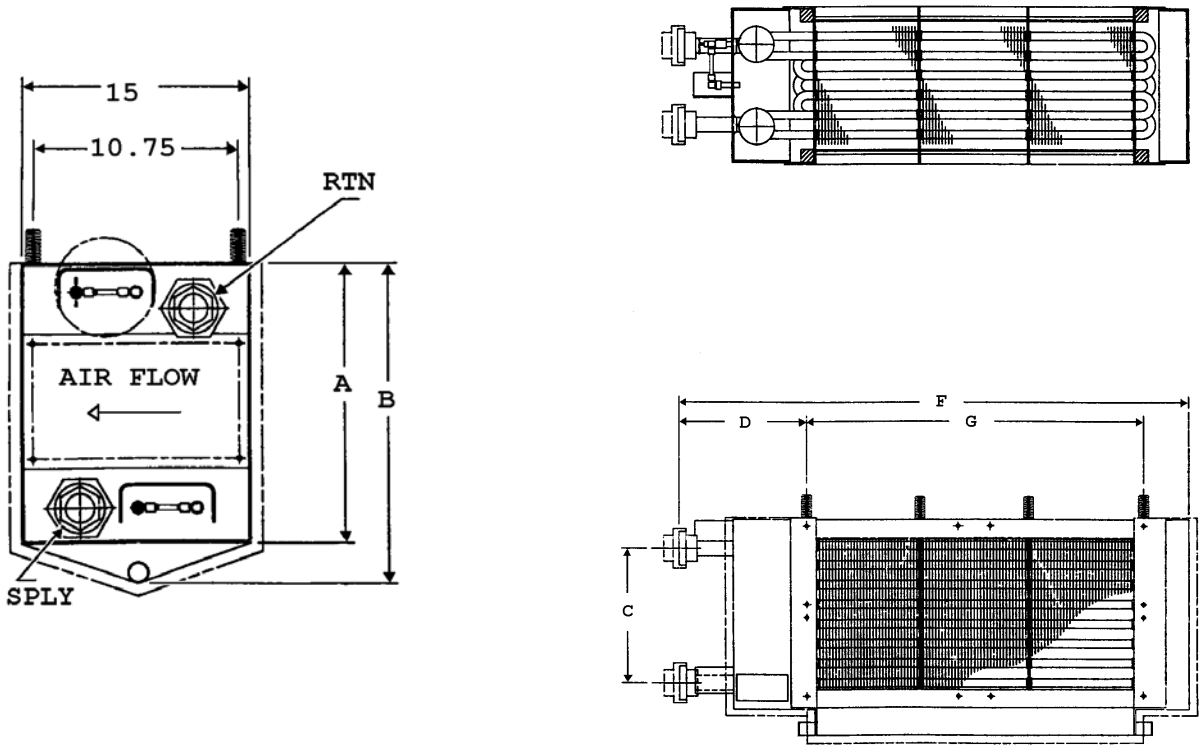


Figure 8-3 Cooling Coil Series 60

PHYSICAL DATA										ORDERING DATA	
COIL SIZE D.W.	FACE AREA SQ FT	DIMENSIONS (INCHES) A	B	C	D	E	F	G	FILTER SIZE QTY	COG	NSN 4130-01
61	0.57	10.00	12.12	6.38	9.25	5.00	26.00	13.25	(1) 11AF	9G	348-1550
62	0.91	12.25	14.38	8.62	9.25	5.00	28.25	15.50	(1) 12AF	9G	348-1551
63	1.4	12.25	14.38	8.62	9.25	5.00	35.25	22.50	(1) 13AF	9G	348-1552
64	2.0	14.50	16.62	10.25	10.00	5.75	40.00	26.50	(3) 11AF	9G	348-1553
65	3.0	16.75	18.88	12.50	10.00	5.75	46.50	33.00	(3) 12AF	9G	348-1554
66	5.0	21.25	23.38	16.00	10.00	5.75	54.50	41.00	(2) 15AF	9G	348-1555
67	7.5	31.50	34.25	23.00	-	-	-	-	(2) 16AF	9G	348-1556
68	10.1	40.50	43.25	32.00	-	-	-	-	(4) 15AF	9G	348-1557

Table 8-5 Cooling Coil Series 60

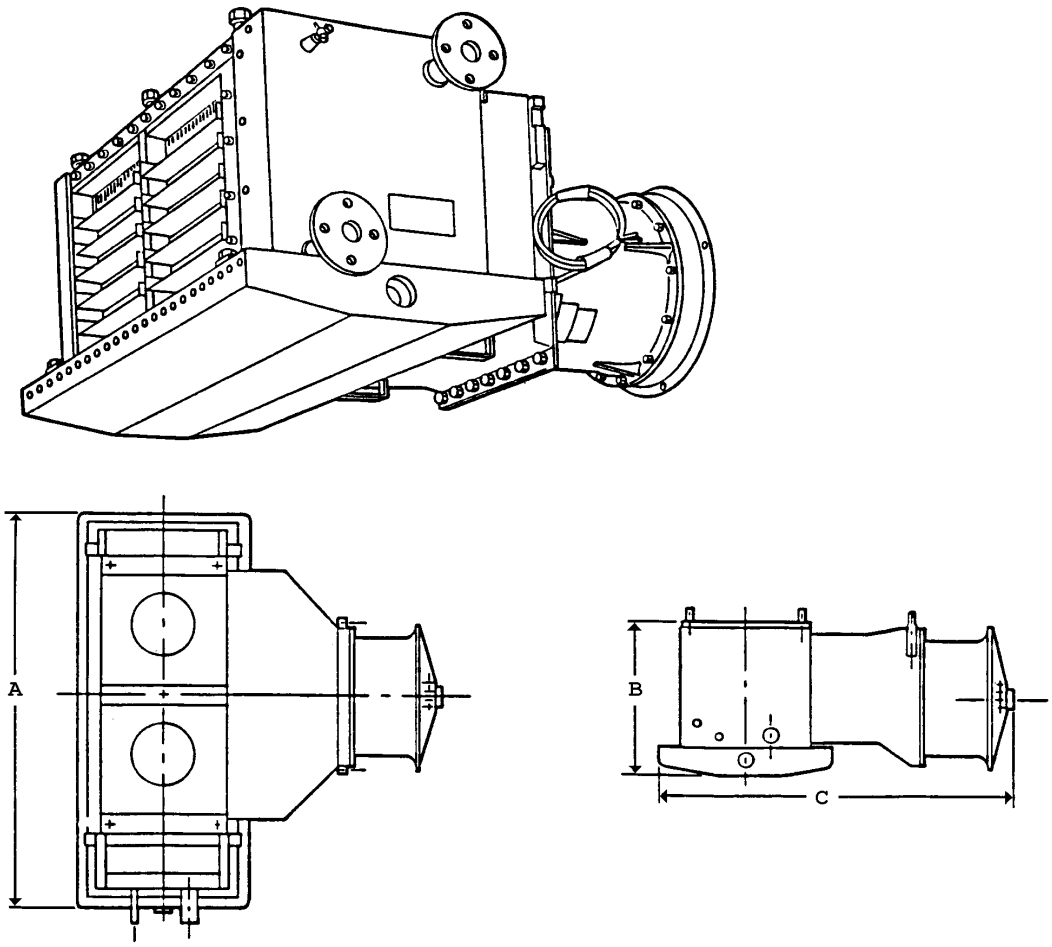


Figure 8-4 Unit Cooler Series 40

PHYSICAL DATA								
COIL SIZE	H.P. (MAX)	CFM APPROX	DIMENSIONS (INCHES)			FILTERS		ORDERING DATA
			A	B	C	QTY	SIZE	
41	1/20	215	28 1/4	12 7/8	44	1	11 AF	REPLACE
42	1/12	340	30 1/2	15 1/8	44	1	12 AF	WITH
43	1/8	510	33 1/2	15 1/8	44 1/2	1	13 AF	FAN COIL UNIT
44	1/6	750	42 1/2	17 3/8	45 1/2	3	11 AF	
45	1/5	1120	50	19 5/8	48 1/2	3	12 AF	

Table 8-6 Unit Cooler Series 40

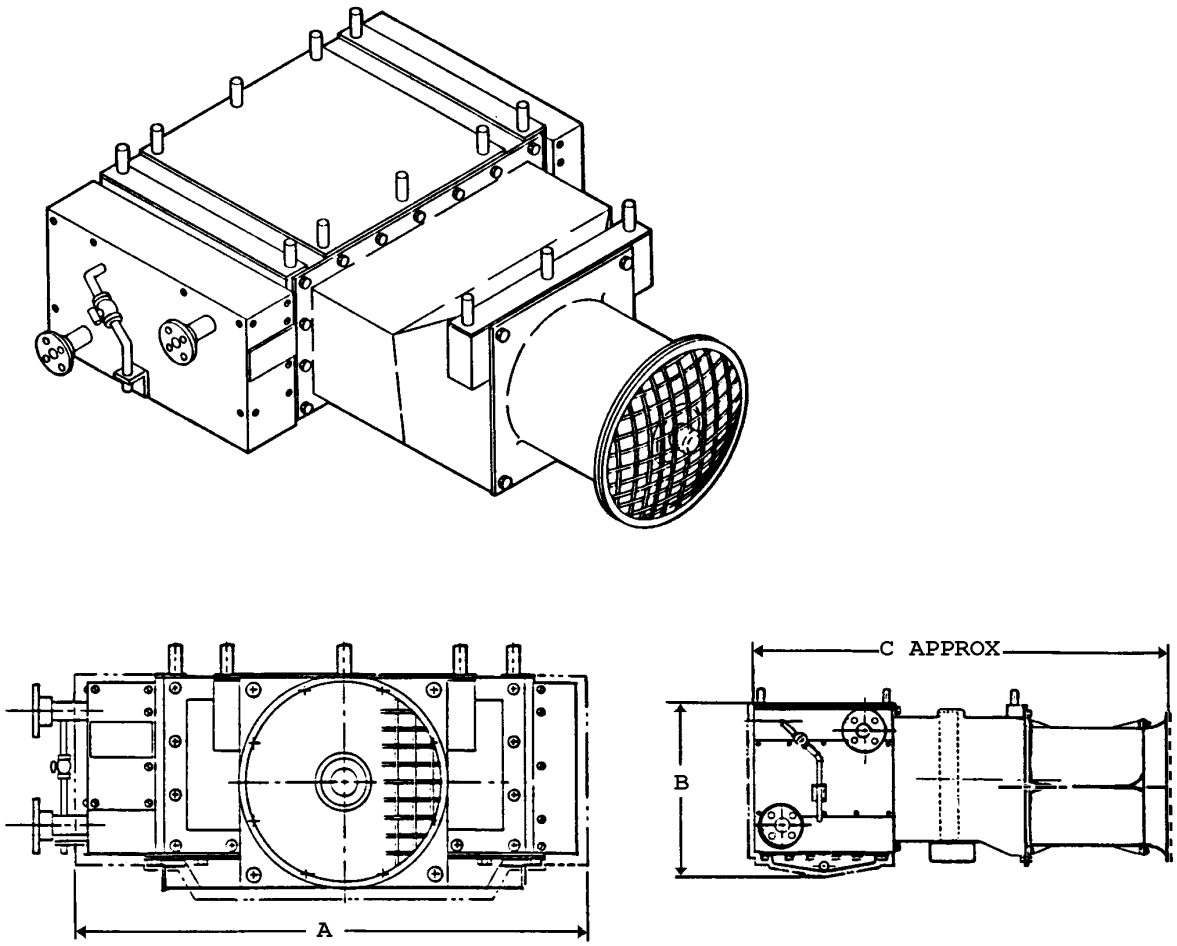


Figure 8-5 Unit Cooler Series 50

PHYSICAL DATA								
COIL SIZE	H.P. (MAX)	CFM APPROX	DIMENSIONS (INCHES) A	B	C	FILTERS QTY	SIZE	ORDERING DATA
51	1/20	215	23	12 3/4	41	1	11 AF	
52	1/12	340	25 1/4	15	41	1	12 AF	REPLACE
53	1/8	510	32 1/4	15	41 1/2	1	13 AF	WITH
54	1/6	750	37	17 1/4	42 1/2	3	11 AF	FAN COIL UNIT
55	1/5	1120	43 1/2	19 1/2	45 1/2	3	12 AF	

Table 8-7 Unit Cooler Series 50

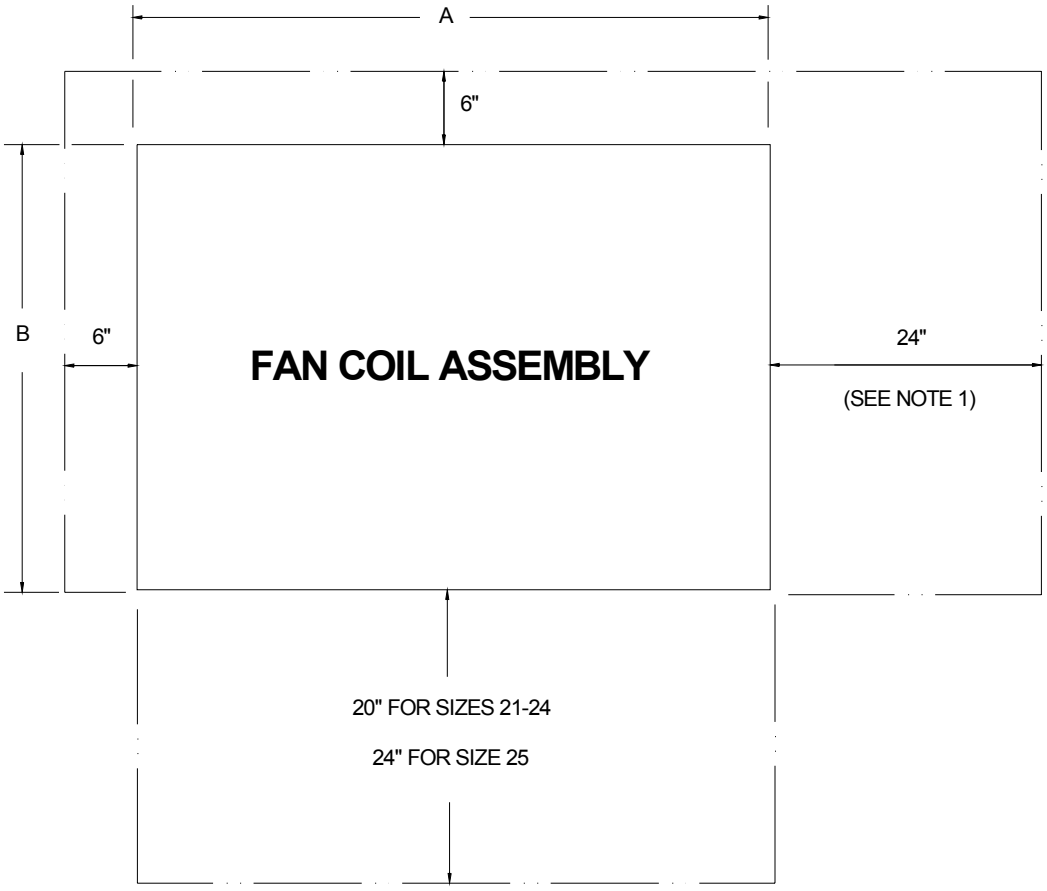


Figure 8-6 Fan Coil Assembly Type "I, II and III

PHYSICAL DATA												
FAN COIL SIZE			DIMENSION (INCHES) TYPE I AND III				TYPE II AIR OUTLETS				FILTERS	
	A	B	OUTLET		INLET		TOP		SIDE		QTY	SIZE
21	44	28	9-1/4	8-5/8	38	6	36	10	14	10	3	11AF
22	44	28	10-7/8	10-3/8	38	6	36	10	14	10	3	11AF
23	48	32	12-1/2	10-3/8	30-3/8	12	42	10	18	10	3	12AF
24	51	37	16-3/4	12	40-1/2	12	44	12	24	10	4	12AF
25	56	37	16-3/4	13-3/8	39-3/8	17-1/2	48	12	24	10	2	15AF

Table 8-8 Fan Coil Assembly Type "I, II and III

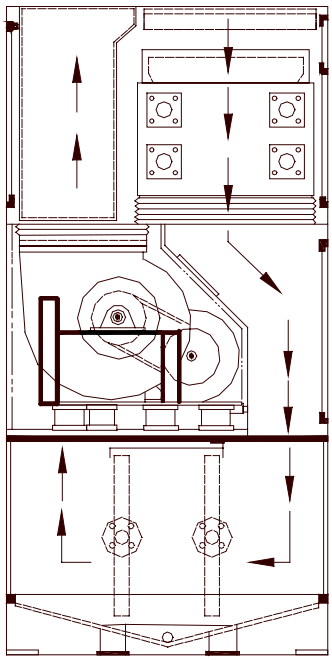


Figure 8-7 Type "I" Fan Coil Assembly

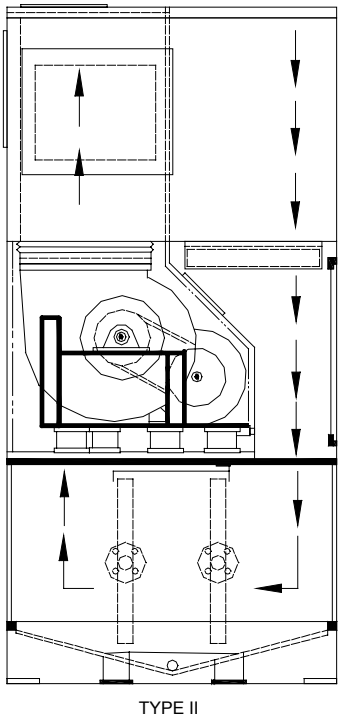


Figure 8-8 Type "II" Fan Coil Assembly

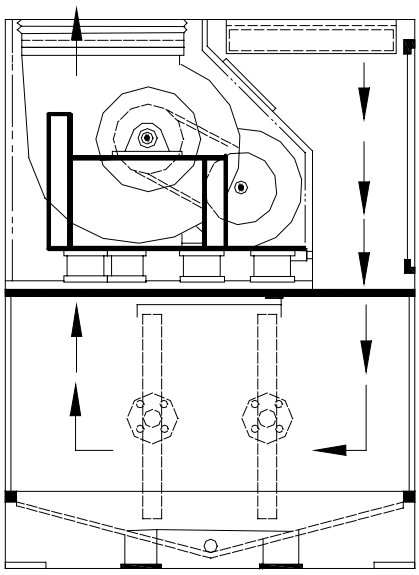
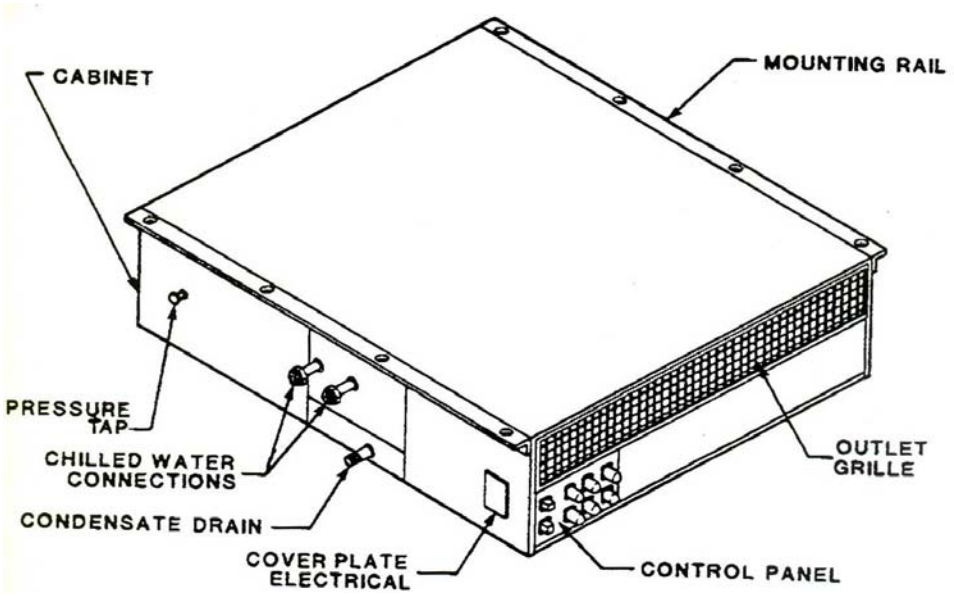


Figure 8-9 Type "III" Fan Coil Assembly



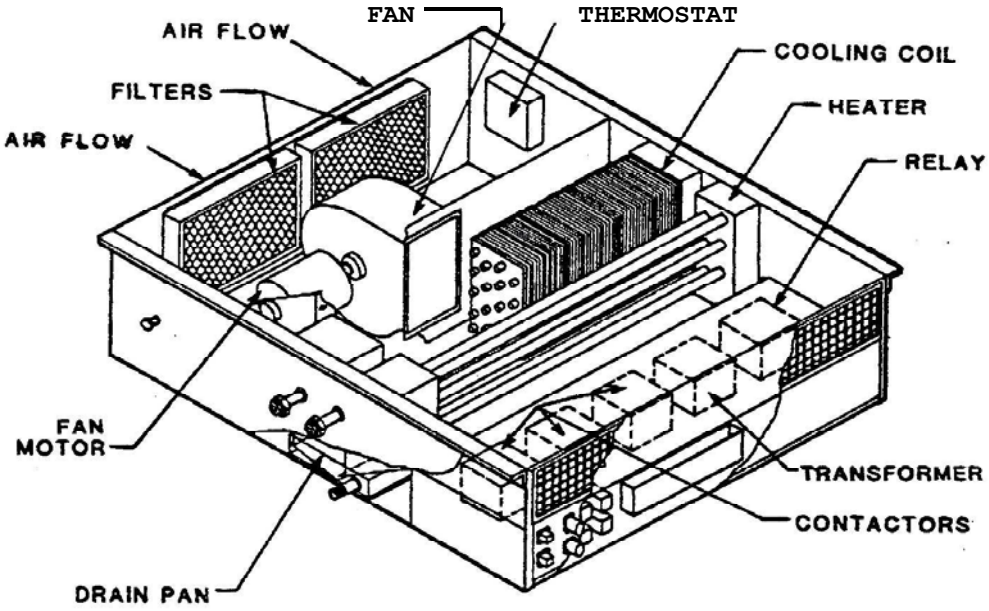


Figure 8-10 Navy Standard Fan Coil Unit

	PHYSICAL DATA TYPE H, CLASS W (LVR)														
									MAXIMUM CAPACITY						NSN
				WTR	DRN	MAX	FILTERS		AIR	COOLING CAPACITY			FAN	CLG COIL FACE	COG 9G 4130-01-225-
SIZE	A	B	C	CONN IPS	CONN IPS	WT LBS	QTY	SIZE	FLOW CFM	MBH	GPM	HTR K.W.	MOTOR HP	AREA SQ FT	*4130-01-276- **4301-01-228
												1.2			2508
H1	25	10	50	1/2	1	275	1	11AF	145	5.85	1.9	2.2	1/4	0.5	2509
												3.3			
												1.2			2510
H2	25	10	50	1/2	1	285	1	11AF	240	9.69	3	2.2	1/4	0.7	*1018
												3.3			
												1.75			
H3	27	14	52	1/2	1	350	1	12AF	350	15.28	4.8	3.5	1/2	1.3	2511
												5.25			*1015
												2.0			**1301
H4	36	14	52	1/2	1	420	2	12AF	530	22.89	7.3	4.0	1/2	1.8	
												6.0			*1020
												2.0			1074
H5	44	14	52	1/2	1	500	2	12AF	690	30.5	9.5	4.0	1/2	2.2	
												6.0			
												3.0			
H6	39	17	52	1	1	500	3	12AF	950	39.91	13.2	6.0	3/4	2.6	2505
												9.0			
												3.0			
H7	52	17	52	1	1	660	4	12AF	1100	45.56	15.1	6.0	3/4	2.8	
												9.0			2507
												3.0			
H8	62	17	52	1	1	780	5	12AF	1650	72.92	24.5	6.0	3/4	4.5	
												9.0			

Table 8-9 Type "H" Fan Coil Unit Class "W"

SIZE	PHYSICAL DATA TYPE H, CLASS Z (LVP)														NSN COG 9G 4130-01-225-*4130-01-276-**4301-01-228 ***4301-01-354
									MAXIMUM CAPACITY					CLG COIL	
	A	B	C	WTR CONN IPS	DRN CONN IPS	MAX WT LBS	FILTERS QTY	FILTERS SIZE	AIR FLOW CFM	COOLING CAPACITY MBH	COOLING CAPACITY GPM	HTR K.W.	FAN MOTOR HP	FACE AREA SQ FT	
												1.2			1592
H1	25	10	50	½	1	275	1	11AF	145	5.85	1.9	2.2	¼	0.5	1593
												3.3			
												1.2			1081
H2	25	10	50	½	1	285	1	11AF	240	9.69	3	2.2	¼	0.7	1082
												3.3			1083
												1.75			1085
H3	27	14	52	½	1	350	1	12AF	350	15.28	4.8	3.5	½	1.3	1590
												5.25			1591
												2.0			1077
H4	36	14	52	½	1	420	2	12AF	530	22.89	7.3	4.0	½	1.8	1078
												6.0			1079
												2.0			2513
H5	44	14	52	½	1	500	2	12AF	690	30.5	9.5	4.0	½	2.2	2514
												6.0			
												3.0			1597
H6	39	17	52	1	1	500	3	12AF	950	39.91	13.2	6.0	¾	2.6	1598
												9.0			
												3.0			1595
H7	52	17	52	1	1	660	4	12AF	1100	45.56	15.1	6.0	¾	2.8	
												9.0			1596
												3.0			
H8	62	17	52	1	1	780	5	12AF	1650	72.92	24.5	6.0	¾	4.5	
												9.0			

Table 8-10 Type "H" Fan Coil Unit Class "Z"

	PHYSICAL DATA TYPE V, CLASS W (LVR)															
									MAXIMUM CAPACITY					CLG COIL	NSN COG 9G 4130-01-225- *4130-01-276- **4301-01-228 ***4301-01-354
				WTR	DRN	MAX	FILTERS		AIR	COOLING CAPACITY		HTR	FAN	FACE	
				CONN	CONN	WT			FLOW				MOTOR	AREA	
SIZE	A	B	C	IPS	IPS	LBS	QTY	SIZE	CFM	MBH	GPM	K.W.	HP	SQ FT	
												1.2			
V1	25	10	50	1/2	1	275	1	11AF	145	5.85	1.9	2.2	1/4	0.5	
												3.3			
												1.2			
V2	25	10	50	1/2	1	285	1	11AF	240	9.69	3	2.2	1/4	0.7	
												3.3			
												1.75			
V3	27	14	52	1/2	1	350	1	12AF	350	15.28	4.8	3.5	1/2	1.3	
												5.25			
												2.0			3H*** 2919
V4	36	14	52	1/2	1	420	2	12AF	530	22.89	7.3	4.0	1/2	1.8	
												6.0			
												2.0			
V5	44	14	52	1/2	1	500	2	12AF	690	30.5	9.5	4.0	1/2	2.2	
												6.0			
												3.0			
V6	39	17	52	1	1	500	3	12AF	950	39.91	13.2	6.0	3/4	2.6	
												9.0			
												3.0			
V7	52	17	52	1	1	660	4	12AF	1100	45.56	15.1	6.0	3/4	2.8	
												9.0			1075
												3.0			
V8	62	17	52	1	1	780	5	12AF	1650	72.92	24.5	6.0	3/4	4.5	
												9.0			

Table 8-11 Type "V" Fan Coil Unit Class "W"

	PHYSICAL DATA TYPE V, CLASS Z (LVP)														
								MAXIMUM CAPACITY					CLG COIL	NSN COG 9G 4130-01-225-*4130-01-276-**4301-01-228
				WTR	DRN	MAX	FILTERS	AIR	COOLING CAPACITY			FAN	FACE	
SIZE	A	B	C	CONN IPS	CONN IPS	WT LBS	QTY	SIZE	FLOW CFM	MBH	GPM	HTR K.W.	MOTOR HP	AREA SQ FT	
												1.2			
V1	25	10	50	1/2	1	275	1	11AF	145	5.85	1.9	2.2	1/4	0.5	
												3.3			
												1.2			
V2	25	10	50	1/2	1	285	1	11AF	240	9.69	3	2.2	1/4	0.7	
												3.3			
												1.75			
V3	27	14	52	1/2	1	350	1	12AF	350	15.28	4.8	3.5	1/2	1.3	
												5.25			
												2.0			
V4	36	14	52	1/2	1	420	2	12AF	530	22.89	7.3	4.0	1/2	1.8	
												6.0			
												2.0			
V5	44	14	52	1/2	1	500	2	12AF	690	30.5	9.5	4.0	1/2	2.2	
												6.0			
												3.0			
V6	39	17	52	1	1	500	3	12AF	950	39.91	13.2	6.0	3/4	2.6	
												9.0			
												3.0			1599
V7	52	17	52	1	1	660	4	12AF	1100	45.56	15.1	6.0	3/4	2.8	
												9.0			1600
												3.0			
V8	62	17	52	1	1	780	5	12AF	1650	72.92	24.5	6.0	3/4	4.5	
												9.0			

Table 8-12 Type "V" Fan Coil Unit Class "Z"

Chapter 9

IX - NAVY STANDARD AIR FILTERS

General knowledge of HVAC air filters.

9-1 INTRODUCTION

9-1a Function

The function of the air filter is two-fold, to remove contaminants from the atmosphere and to keep the duct system and its components clean.

9-1b Dirt accumulation

Dirt accumulation within the system and on its components can cause the following problems.

9-1b.1 Create a fire hazard.

9-1b.2 Reduce the heat transfer capacity of steam duct heaters and chilled water cooling coils. A very thin coating of dirt, particularly oily deposits, on the fin-tube elements in the cooling coils can reduce the coil capacity by 20% or more.

9-1b.3 Reduce total system airflow. Lightly dirty filters alone can reduce airflow by as much as 30% or more. Heavy dirt accumulation on filters, screens, and fan blades can easily result in 50-100% loss of total airflow.

9-1b.4 Decrease the reliability of control settings. Dirt on the control element reduces the sensitivity of the element response. This increases the lag time (length of time to respond to change) which in turn causes excessive fluctuation in temperature and humidity conditions.

9-2 TYPES OF FILTERS

9-2a Navy Standard Filter

Navy Standard Filters are used to remove contaminants from the ship's atmosphere, refer to Figure 9-1 and Table 9-1. These filters consist of crimped wire mesh media mounted in a frame and installed in the filter housing preceding the cooling coils (refer to Table 9-9 for a list of cooling coil drawings). The filters remove dirt by impingement at air velocities of 300 to 800 feet per minute (FPM). Air velocities in excess of 800 FPM tend to unload these filters.

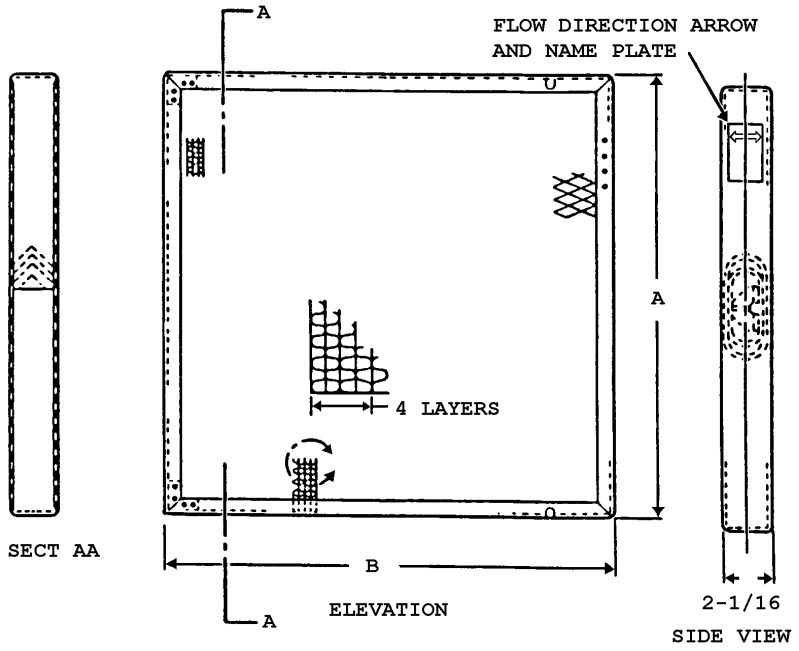


Figure 9-1 Navy Standard Filter

PHYSICAL DATA						ORDERING DATA	
FILTER SIZE	NET AREA SQ FT	DEMENSIONS (INCHES) A	DEMENSIONS (INCHES) B	MATERIAL	NET WT LBS	COG	NSN 4130-00
10 AF	.25	7.25	7.25	STL	.2	9G	595-0138
				AL	.1	9G	640-0243
11 AF	.53	12.5	8	STL	.4	9G	595-0136
				AL	.1	9G	640-0242
12 AF	.80	14.5	10	STL	.5	9G	595-0135
				AL	.1	9G	640-0241
13 AF	.12	10	22	STL	.7	9G	595-0134
				AL	.2	9G	640-0240
14 AF	.23	15.5	24.5	STL	.1	9G	595-0139
				AL	.4	9G	640-0239
15 AF	.23	19.5	19.5	STL	.1	9G	595-0133
				AL	.4	9G	640-0238
16 AF	.35	19.5	29.5	STL	.1	9G	595-0137
				AL	.5	9G	640-0237

Table 9-1 Navy Standard Filter

9-2b Renewable Media Filter

Navy standards are not available for this type of filtration device, this information is based on commercially available types. Renewable media type filters are available in vertical and horizontal models to fit space requirements and come in a wide range of sizes and ratings. Depending on the manufacturer, commercial filters are available in capacities of 2500 CFM to 195,000 CFM with dimensions ranging from approximately 3 to 30 feet wide and from 2 to 14 feet high.

Renewable media filters are used in supply ventilation intakes on ships which operate in areas where large amounts of particulate would rapidly clog non-renewable filters, in machinery spaces to protect against carbon and boron fibers, and in Collective Protection Systems applications. The vertical renewable media type filters consist of two rollers, one at the top of the unit and the other at the bottom. A roll of filtering medium is placed on the upper roller, unrolled across the air stream, and rewound on the bottom roller.

As the air passes through the filter media, dust, dirt and other particles are filtered out. The filter media is unrolled by one of several methods and when the entire roll has been wound on the lower roller, it is discarded and a new roll placed in the upper roller.

The horizontal model operates in a similar manner. The filter media may be unrolled either by a motor drive or manually. The motor driven assembly is designed to limit the amount of dirt accumulation on the portion of the filter media in the air stream. The controls typically available for control of the motor drive assembly include timing, pressure drop and photoelectric devices. The timing control unrolls the media at predetermined time intervals. Pressure controls advance the media when the increase in dirt load across the media causes the pressure drop to increase to a specified value. The photoelectric control uses a light source and photocell to actuate the motor drive when the amount of accumulated dirt reduces the amount of light reaching the photocell below a certain value. A media run out switch operates a warning light and disconnects the motor drive when the supply of filter media is nearly exhausted. The filter media is made of glass fiber mounted on spools, which allow for easy replacement. Dirt removal efficiency of the filter media should be more than 80%. The normal operating pressure drop range is 0.45 inches of water gage (w.g.) to 0.55 inches w.g. at an air velocity of 500 FPM

9-2c High Efficiency Particulate Air (HEPA) Filter

HEPA filters are designed to have an efficiency of at least 90% on 0.3-micron smoke. Typically HEPA filters are installed in spaces such as operating rooms, surgical dressing rooms and bacteriological lavatories where air quality requirements are stringent and contamination of other areas is possible. HEPA filters are also used in conjunction with charcoal filters as part of the Collective Protection System. The HEPA filter is of the throwaway type. The high efficiency filters utilize a high ratio of surface area to face area by pleating a continuous sheet of media into closely spaced separators, refer to Figure 9-2 & Table 9-8. This effectively reduces the air velocity through the media and provides greater filtration and dirt holding capacity. The filter media is typically made of waterproof glass fiber material of sufficient thickness to provide high tensile strength. a pressure differential gauge is used to measure the pressure drop across the filter to determine when the filter is to be replaced.

9-2d 3 PLY High Efficiency Disposable Filters

3 PLY disposable filters are used as a direct replacement for Navy Standard Filters. They are used to remove contaminants from the ship's atmosphere and should be used in lieu of Navy standard filters.. They come in 3 styles, panel, cube and link. Panel filters are use in the majority of the HVAC systems, refer to Table 9-2. Cube filters are used for NIMITZ Class Fan Coil Units (FCU's) manufactured by Newport News Shipbuilding, refer to Table 9-3. The filter links are used on machinery space supply systems, refer Table 9-4. Disposable Filters may appear dirty well before the end of their service life. The filter is considered at the end of its useful service life when the fibers of the filter media can no longer be seen and the filter is covered with a "cake" of dirt. A simple test is to hold a flashlight to the back of the filter. If light does not shine through the filter, the filter should be cleaned or replaced.

FILTER PANEL SIZE	Part Number	NSN	APL
10AF	NV103P1	9Z 4130-01-504-0642	48A030004
11AF	NV113P1	9Z 4130-01-504-0643	48A030005
12AF	NV123P1	9Z 4130-01-504-0647	48A030006
13AF	NV133P1	9Z 4130-01-504-0649	48A030007
14AF	NV143P1	9Z 4130-01-504-0651	48A030008
15AF	NV153P1	9Z 4130-01-504-0653	48A030009
16AF	NV163P1	9Z 4130-01-504-0657	48A030010

Table 9-2 3 PLY High Efficiency Panel Filters

CUBE FILTER SIZE	PN	NSNs	APL
14AF	NV14C3P1	9Z 4130-01-501-7405	48A030011
15AF	NV15C3P1	9Z 4130-01-501-7411	48A030012

Table 9-3 3 PLY High Efficiency Cube Filters

FILTER LINK SIZE	PN	NSNs	APL
8 20X25 Links (20x200)	C1TL20200-3	9Z 4130-01-500-6023	48A030013
8 25x20 Links (25x160)	C1TL25160-3	9Z 4130-01-500-6016	48A030014

Table 9-4 3 PLY High Efficiency Filter Links

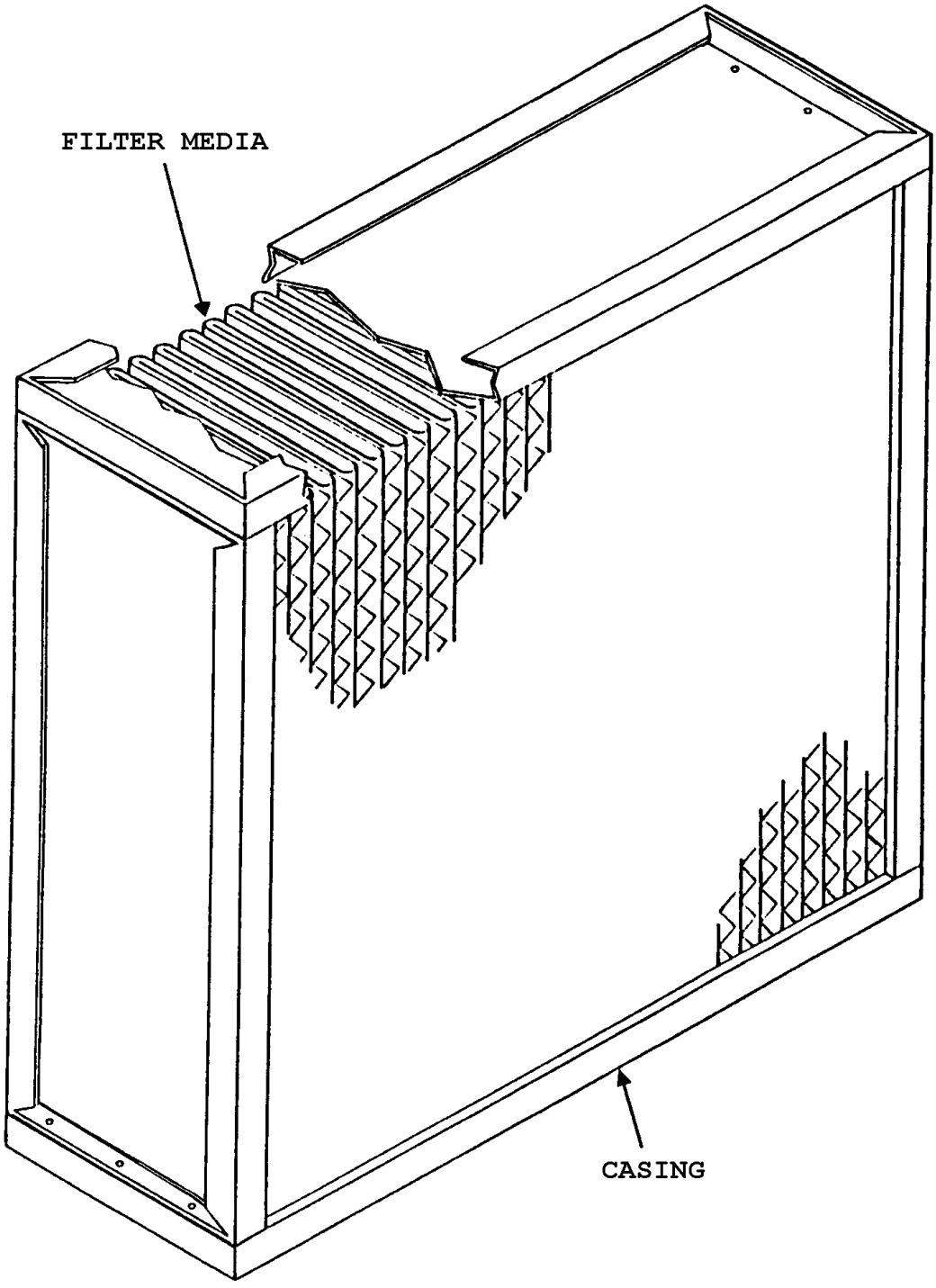


Figure 9-2 HEPA Filter

9-2d Temporary In-port Filters

Weather air intakes of some ships (standard on new construction) are provided with permanently fixed coamings that are approximately two inches deep in the direction of airflow, for the attachment of temporary in-port air filters. During yard overhauls and while in port, the coamings are fitted with filtering material, NSN 9330-00-965-0481. This material is stretched over the coaming and secured by wrapping a piece of cord or wire around the exterior of the coaming (over the edges of the material). This temporary filter will decrease the amount of supply air to the space with a subsequent increase in space temperature. The filter material should be renewed at specified intervals to maintain clean supply air with a minimum decrease in airflow. Filters that become clogged with dirt and debris result in a decrease in supply air and may ultimately cause compartments to become excessively hot, due to airflow restriction. Such an environment could subject the occupants to conditions that could result in heat stress.

9-3 DIFFERENTIAL PRESSURE GAGES

Differential pressure gages are installed across the filters in the recirculation systems serving vital control and electronic spaces. These gages provide a means of checking for filter clogging; refer to Figure 9-3 and Table 9-5.

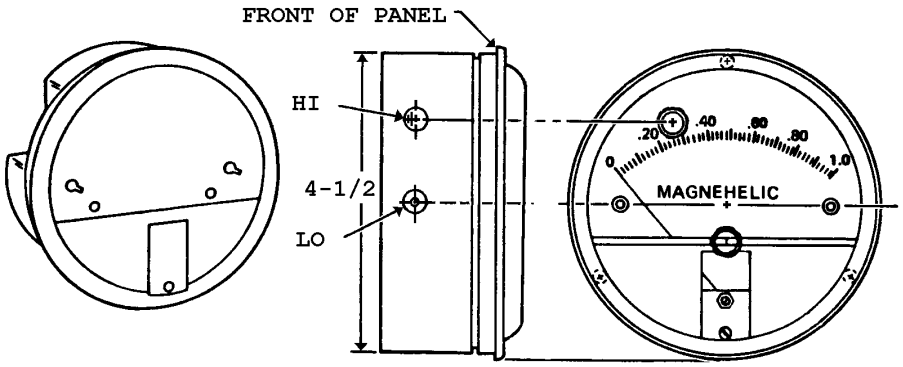


Figure 9-3 Filter Gage Type 2

	ORDERING DATA	
SIZE	COG	NSN
220-1/2 AF	9G	6680-00-071-2944
2201 AF	9G	6685-00-063-8951
2002 AF	9G	6685-00-910-6964
2003 AF	9G	6685-00-063-8974
2004 AF	9G	6685-00-071-2945
2005 AF	9G	6685-00-056-9069

Table 9-5 Differential Pressure Gage

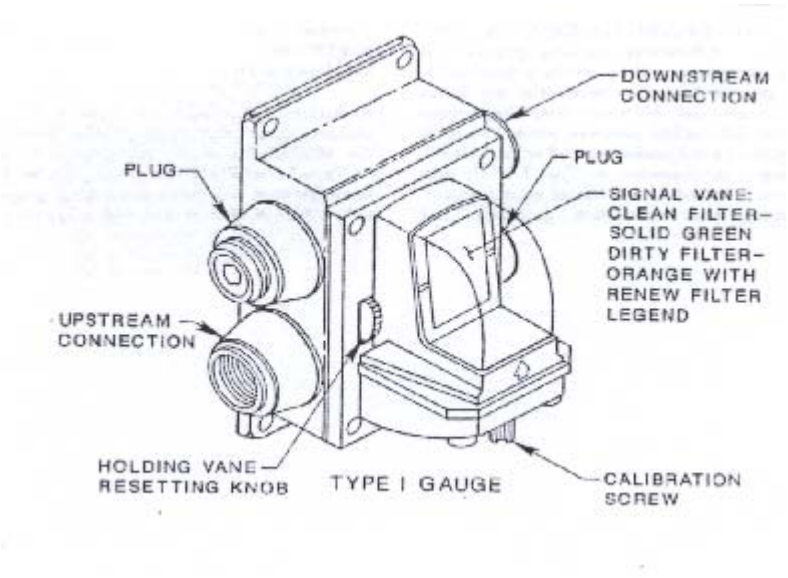


FIGURE 9-4 Filter Gage Type 1

9-4 AIR FILTER GAUGES

Air filter Gauges are classified as Type I or II, with each type supplied by a different manufacturer. Application and installation guidelines are provided by drawing, NAVSHIPS No. 804-1577080. Type I and II Air Filter Gauges are shown on Figure 9-3 & 9-4.

9-5 FILTER MAINTENANCE

9-5a Replacement procedure (navy standard filters)

There are three different procedures that can be used to replace dirty filters. These are as follows:

9-5a.1 Secure and tag out system remove filters and take to filter cleaning shop. When cleaned, return to system and re energize the system. (System down time is as much as two hours), for filter PMS requirements see Tables 9-3 and 9-4.

9-5a.2 Similar to first procedure, except dirty filter is turned in to filter cleaning shop and a clean one is issued without wait (system down time as much as 30 minutes).

9-5a.3 Go to Filter Cleaning Shop and check out filter. Secure system and change filter, re-energize system and return dirty filter to Filter Shop (system down time approximately 5 minutes).

9-5b Note

9-5b.1 All filter removal, cleaning, and replacement should be accomplished in accordance with the step by step procedures on the appropriate Maintenance Requirement Cards.

9-5b.2 Each ship should develop enough spares to have a rotatable pool, and can then use the third procedure to keep filtered systems operating with as little down time as possible.

9-5b.3 Do not replace the HEPA filters monthly. Replacement of the HEPA throwaway type filter is to be based on the pressure differential indicator.

9-5c Filter Maintenance Requirements

PMS requirements for filters are shown in Tables 9-6 and 9-7.

Item	Type of System	MIP	Control Number	Requirement
Flame Arrester	Exhaust	6641/5	W31G	Quarterly
Ducted Systems	Recirc	6641/5	W31G	Quarterly
Unit	Recirc	6641/5	W31G	Quarterly

Table 9-6 PMS Requirements for Air Filters

Item	Type of System	MIP	Control Number	Requirement
Hull Screen	Sup/Exh	6641/5	W32Y	Weekly while in SRA/COH

Table 9-7 PMS Requirements for Temporary Filters during SRA/COH

9-5d HEPA Air Filters

NSN 4130-	APL	SIZE	MATL	CFM	ΔP	COST	SERVICE
00-972-9433		24x24x12	304L			712	
00-972-9432		23.875X23.87 5X5.5875	304L			213	
01-347-6190 00-176-4428	489980469	24x24x12	STEEL	2000	1.35	223	CPS-LIMITED PROTECTION

Table 9-8 HEPA Air Filters

9-5e Filter List Development

In order to properly maintain the large number of filters on an aircraft carrier each ship must develop an Equipment Guide List (EGL) containing the following information:

9-5e.1 Compartment number

9-5e.2 System number

9-5e.3 Element number (cooling coil, unit cooler or flame arrester).

9-5e.4 Filter size and quantity

9-5e.5 Division responsible

9-5e.6 Pick-up initials: Division DCPO or Filter Shop

9-5e.7 Return initials: Division DCPO or Filter Shop

9-5e.8 Remarks

A filter list can be developed by obtaining the List of Cooling Coils and Zone Inspection List.

DWG. NO.	TITLE
CV63-501-1679050	AIR CONDITIONING LIST OF DUCT TYPE COOLING COILS
CV64-501-1355194	AIR COND DUCT TYPE COOLING COILS
CVN65-501-1554562	VENT LIST OF DUCT TYPE COOLING COILS & COOLING COIL FILTERS
CV67-501-2447818	VENTILATION LIST OF DUCT TYPE COOLING COILS
CVN68-501-2648253	VENT COIL LIST
CVN69-501-2648250	LIST OF COOLING COILS
CVN70-501-5003764	VENT & A/C CHW LIST OF DUCT TYPE COOLING COILS
CVN71-501-5563666	VENT & A/C CHW LIST OF DUCT TYPE COOLING COILS
CVN72-501-5940525	VENT & A/C CHW LIST OF DUCT TYPE COOLING COILS
CVN73-501-6296174	VENT COIL LIST
CVN74-501	
CVN75-501	

Table 9-9 List of Cooling Coil Drawings

Chapter 10

X - ELECTROSTATIC PRECIPITATORS

General knowledge of electrostatic precipitators.

10-1 INTRODUCTION

Electronic air cleaners are provided in air conditioning systems that serve AIMD spaces where a high degree of air cleaning is required. These units consist of a dirt collecting element referred to as the precipitator and a power supply referred to as the power pack. The power pack converts a 115-volt, 60-hertz ac supply into the high voltage dc necessary to power the ionizing-collecting section in the precipitator.

10-2 PRINCIPLES OF OPERATION

The electronic air cleaner is technically known as a two-stage electrostatic precipitator. In the first stage of operation, all airborne particles, even those of sub microscopic size, are electrically charged (positively) as they pass through an ionizer where a high concentration of ions emanate from fine tungsten wires charged with high voltage. In the second stage of operation, the charged particles pass into an electrical field set up between a series of paragraphllel aluminum plates. Here the positively charged particles are attracted to the plates forming the negative element of the field. This field is created by placing a positive charge of high voltage on each alternate plate in the series, while the interleaving plates are relatively negative or electrically grounded.

10-3 PRECIPITATOR TYPES

There are two different configurations for the electronic precipitator, the old style "wash in place" units and the more modern style "modular" units refer to Figure 10-1 and Table 10-1.

10-4 PRECIPITATOR CLEANING

Two EGL's must be developed, one for "wash in place" units and one for "modular" units, as the two different types of precipitators require different maintenance procedures.

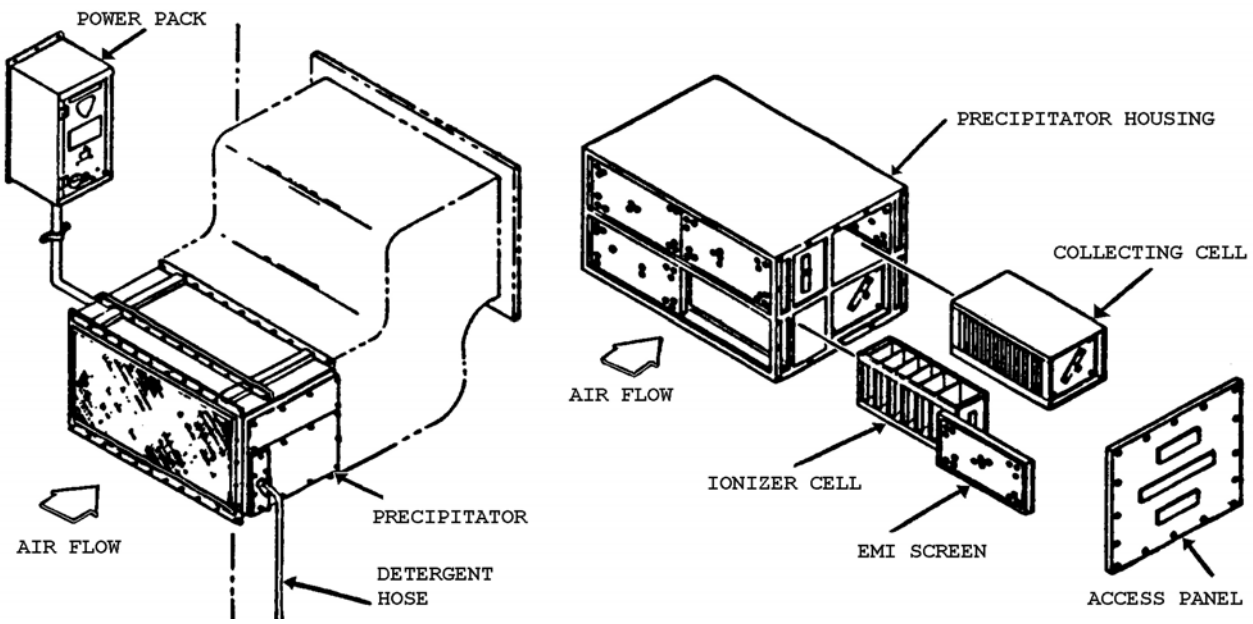


Figure 10-1 Electrostatic Precipitator

ORDERING DATA			
MODEL NO.	APL	COG	NSN 4460-00 *4460-01
37-8969	480790015	7H	088-1994
37-8969-1	480790028	9C	*197-8628
37-8970	480790016	7H	088-2624
37-9221	480790034		
37-9222	480790035		
35-9576	480790045		

POWER PACK ORDERING DATA			
MODEL NO.	APL	COG	NSN 6130-01
1-8976	111940029	9G	150-1468
1-8976-1	111940014	9G	150-1468
1-8976-1	111940015	9G	150-1468
1-9138	111940017		

ORDERING DATA			
MODEL NO.	APL	COG	NSN 4460-01
44-9652	480790086		
44-9654	480790061	9C	033-7749
44-9656	480790067	9C	137-0930
44-9657	480790074	9C	137-0929
44-9681	480790054	9C	197-7756

POWER PACK ORDERING DATA			
MODEL NO.	APL	COG	NSN 6130-01
423100-001	111940029	9G	165-8864
423100-002	111940033	9G	168-4383
423100-004	111940031	9G	131-3372

Table 10-1 Electrostatic Precipitator

COMNAVSEA MSG. 202141Z NOV 87: When ESP's become uneconomical to maintain, Ship's Force is authorized to remove and dispose of ESP internal components except from Medical/Dental spaces and Composite Material Repair Shops. Removals shall be documented under the 3M system. Existing Navy Standard Filters will be retained as sufficient filtration, and shall be maintained IAW Chapter 9 – Navy Standard Air Filters.

Chapter 11

XI - FLAME ARRESTERS

General knowledge of flame arresters.

11-1 INTRODUCTION

Flame arresters consisting of a frame and an arresting cell (screening cell) are installed on the intake side of the exhaust fan, outside the compartment or space protected, and in a non-watertight section of the exhaust above FWL-II. Navy Standard Air Filters are provided in the casing in front of the arresting cell to reduce the necessity for frequent cleaning of arrester cells, since air filters are more readily removed for cleaning than flame arresters.

CAUTION: Flame arresters must be removed from ventilating systems prior to painting compartments served by these systems. Accumulation of paint on the cells cannot be dislodged by steam cleaning; thereby the cells are rendered useless and dangerous by the increase in pressure drop across the flame arrester with a subsequent decrease in airflow.

11-2 REQUIREMENTS

Navy Standard Flame Arresters, refer to Figure 11-1 and Table 11-2, shall conform to MIL-F-17548 and be installed as specified in the Design Criteria Manual, 0938-018-0010 as modified by SHIPALT CV6204 and CVN6205.

In accordance with SHIPALT CV6204 and CVN6205, spaces serving gasoline systems require fixed inert gas flooding/fire extinguishing system/flame arrester/filter with differential pressure gage and associated alarms. Paint mixing and issue rooms and flammable liquid storerooms do not require a flame arrester/filter assembly when related ventilation systems and closures are classified material condition Zebra. Spaces serving JP-5 systems do not require flame arresters.

11-3 ALARM SYSTEM

Compartments and spaces provided with flame arresters in ventilation ducts are also provided with a circuit HF alarm system, which provides an alarm indication when the ventilation system is secured or blocked. Clean flame arrester cells and air filters will prevent actuation of the circuit HF alarm due to exhaust system blockage.

11-4 MAINTENANCE REQUIREMENTS

Flame arresters must be cleaned at specified intervals to maintain clean exhaust ducts. Flame arresters that become clogged with dirt, lint, and debris result in a decrease of exhaust ventilation and may ultimately cause a concentration of explosive vapors in the protected compartment. Flame arrester cells require cleaning when the pressure drop across the cell increases to twice the loss of the clean cell, as read on the airflow meter. The flame arrester should be temporarily removed from the ventilation system if the system is used for compartment ventilating purposes during a yard overhaul. Debris, dirt, and lint can quickly clog the fine mesh of flame arrester cells. After cleaning, or removal for any reason, the entire flame arrester assembly should be carefully reinstalled. A poorly fitted assembly, or one with parts missing, can increase the possibility of a fire hazard. PMS requirements for flame arresters are shown in Table 11-1.

Item	Type of System	MIP	Control Number	Requirement
Flame Arrester	Exhaust	6641/5	W32D	Annual
Filter	Exhaust	6641/5	W31G	Quarterly

Table 11-1 PMS Requirements for Flame Arrester

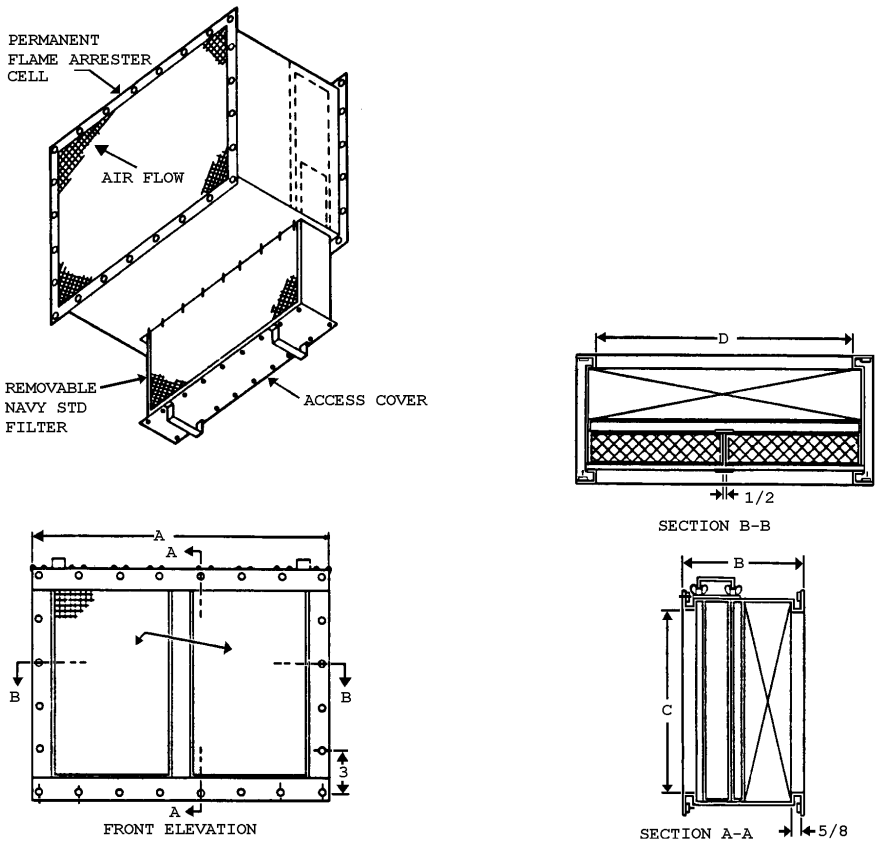


Figure 11-1 Flame Arrester

PHYSICAL DATA								
	DIMENSIONS (INCHES)				AIR FILTER DATA		ORDERING DATA	
COIL SIZE	A	B	C	D	NUMBER OF FILTERS	FILTER SIZE	COG	NSN 2040-00
31	9.375	9.25	6.25	6.375	1	10 AF	9G	060-4571
32	14.625	10	7	11.625	1	11 AF	1H	060-4568
33	16.625	12	9	13.625	1	12 AF	9G	060-4573
34	18.625	14.5	11.5	15.625	2	11 AF	9G	060-4574
35	22.625	16.5	13.5	19.625	2	12 AF	9G	060-4572
36	22.625	24	21	19.625	2	13 AF	9G	060-4567
37	33.125	24	21	30.125	3	13 AF	9G	060-4570
38	41.625	31.125	28.5	38.625	2	16 AF	1H	060-4569

Table 11-2 Navy Standard Flame Arrester

Chapter 12

XII GREASE INTERCEPTOR HOODS

General knowledge of grease interceptor hoods for galley ventilation systems.

12-1 INTRODUCTION

Grease Interceptor hoods, refer to Figure 12-1, are installed over galley and bakery ranges, griddles, fryers, steam kettles, and oven vents. For detailed information about these units refer to NAVSEA Tech Manual 0910-LP-080-1600, Exhaust Ventilation Galley Cooking Equipment and NAVSEA STD Drawing 805-1749099C.

12-2 FIRE DAMPERS

Hoods are provided with fire dampers, which may be closed manually by pulling the damper control handle or by pressing the automatic control of a thermostat located in the ductwork leading to the hood.

12-3 THERMOSTATS

All thermostats on an exhaust system are electrically interconnected in series. A fire in the system from any unit will close dampers on all units and will stop the exhaust fan. Power failure will also close the dampers. When the fire is extinguished and power is restored, the damper control handle should be pushed to open the damper. Should fire cause any thermostat to become inoperative it must be replaced before dampers can be reset.

12-4 GREASE INTERCEPTOR HOOD MAINTENANCE REQUIREMENTS

The PMS requirements for Gaylord Hoods are shown in Table 12-1. Some replacement parts are shown in Table 12-2.

Item	Type of System	MIP	Control Number	Requirement
Clean and inspect Detergent Tank & Foot Valve	Exhaust	5121/4	Y31P	Annually
Test Damper	Exhaust Control Switch	5121/4	W62D	Quarterly
Test Thermostat Switch	Exhaust	5121/4	X71T	24M-3
Clean Vent Grease Filters	Exhaust	5121/4	N45C	Daily or as Required
*Clean & Inspect Hood & Detergent level	Exhaust	5121/4	T54N	Daily or as Required
*Clean & Inspect Hood & Detergent level	Exhaust	5121/4	B2MP	Daily or as Required

Table 12-1 PMS Requirements for Grease Interceptor Hoods

Note: *Recommend use detergent "G-510" NSN 9C 7930-01-380-8460.

GAYLORD PART NO.	DESCRIPTION	NSN	REMARKS
GI107PT	PRESSURE/TEMPERATURE GAUGE	6685-01-154-4136	
VF-100P-SPK-1	PUMP HEAD/FOOT VALVE KIT	4320-01-061-7559	
VF-019A	CAM #1,2,3, OR 4	3040-01-327-2005	SPECIFY SIZE
VF-029A	Spring	5360-00-465-7245	
VF-030B	Pump head	4320-01-297-0300	WITH ALL FITTINGS
SCCLCO22XXALXA	Agastat time delay relay	5945-01-172-9821	
WO75	Transformer	5950-01-215-7221	440-115 VOLT
ALW2BL-CC-G	Color cap green	6210-01-215-3199	
ALW2BL-CC-R	Color cap red	6210-01-215-3200	
ST-ALF-0600	Start switch assembly	5930-01-205-8057	
SP-ALF-0600	Stop switch assembly	5930-01-205-8056	
NC-1357A	Fire switch	5930-01-032-4486	
RG-1357A	Replacement glass bar	9390-01-373-7066	
SRK-N-68	Damper control repair kit	5945-01-007-5162	
GI-3	Single nozzle	4730-01-278-6230	
GI-6	Double nozzle	4730-01-283-3155	

Table 12-2 Replacement Parts for Grease Interceptor Hoods

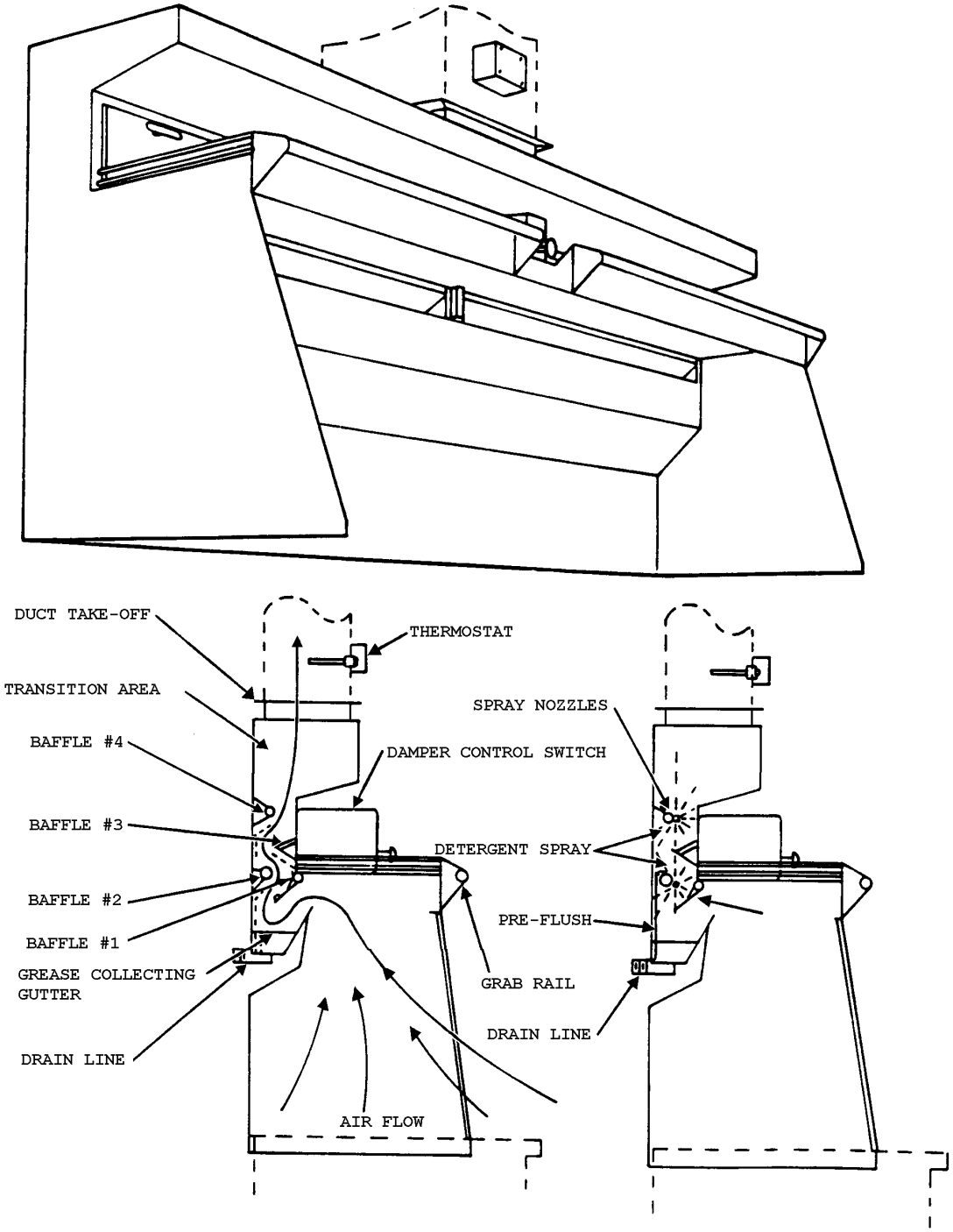


Figure 12-1 Automatic Fire Damper (Grease Interceptor Hood)

Chapter 13

XIII - THERMOSTATIC CONTROL

General knowledge of thermostat function and maintenance.

13-1 INTRODUCTION

The function of thermostatic controls is to provide manual or automatic control of equipment operation and compartment temperature.

13-2 TEMPERATURE REGULATORS

Temperature regulators (valves and thermostats) are provided for ventilation supply systems. The Navy Standard Temperature Regulator is a simple packless valve actuated by a self-contained fluid thermostatic control, refer to Figures 13-1, 2 and 3 and Tables 13-1 through 13-5.

13-2a Preheaters

Two valves are necessary for preheater regulation, either in a single valve body or in separate bodies. One valve is selected for a capacity of about 25% of the required preheater condensate rate. This valve is controlled by a model "W" non-adjustable duct thermostat, installed upstream of the heater. It is set by the manufacturer to open at 35°F (2°C). The other valve, used to maintain the desired preheat temperature, has a capacity of three-quarters of the preheater condensate rate. It is installed downstream of the heater and is controlled by a model "L" thermostat provided with an adjustment device. For moderate capacities, the model "D" regulator combines both of these valves into a single unit. For larger preheaters, two separate regulators are required, see Table 13-1.

13-2b Reheaters

A single valve is used for reheaters, controlled by a bulkhead mounted "R", or room thermostat for ventilation supply systems. Reheaters in recirculating air conditioning systems use a single solenoid operated valve, Figure 13-7 and Table 13-9, controlled by a 2PD Thermostat (see paragraph 3).

13-2c Combination heaters

Combination heaters are fitted with a duct control regulator to prevent condensation and a room control regulator to maintain interior space temperature. The duct regulator, with a Model "W" thermostat, has a capacity of 25% of the total condensate rate of both heaters. The

room control, carrying the remaining 75% of the total capacity of the heater, is fitted with a Model "R" thermostat. Model "D" regulators, fitted with "R" instead of "L" thermostats, are normally used for combination heaters, refer to Figure 13-1 and Table 13-2.

REGULATORS FOR USE WITH PREHEATERS OF STEAM CAPACITY GREATER THAN 445 LBS. PER HOUR		
DESIGN	WEATHERSIDE	
HEATER	CONTROL WITH	
STEAM	MODEL "W"	MODEL "L"
CAPACITY	THERMOSTAT	THERMOSTAT
(LBS PER HR)	VALVE NO.	VALVE NO.
610	E-9	G-32
800	E-10	G-33
1225	E-12	G-34
1850	G-32	G-41
2600	G-33	H-42
3600	G-34	H-43

Table 13-1 Large pre-heater valve combinations

13-3 DUAL THERMOSTATS

Two position dual (2PD) thermostats, Figures 13-4, 13-5, and Table 13-4 and 13-5, are used in air-conditioned spaces to control room temperature. Thermostat micro switches operate on-off valves on the steam heater and cooling coil, Figures 13-6 through 13-9 and Table 13-6 through 13-9. For electric heaters the thermostat actuates contactor instead of valves. On each individual thermostat, switches are interlocked so they cannot operate the cooling coil and heater at the same time. However, system cooling coils and heaters may be operated simultaneously in areas requiring re-heat. This occurs when one thermostat energizes the cooling coil and another thermostat energizes a particular heater. The 2PD thermostat can be used to control just the cooling coil or just the heater by wiring one switch only. A lock screw is provided to prevent unauthorized changing of the setting. Authorized personnel may change the setting by loosening the lock screw and rotating the dial and knob.

13-4 ISE ADVISORY 006-90 TWO - POSITION - DUAL (2PD) AIR CONDITIONING THERMOSTAT ADJUSTMENT PROCEDURE

13-4a Summary

This advisory provided guidance to all ships on testing and adjusting 2PD thermostats for A/C systems. These thermostats are often maladjusted and cause the heating and cooling systems to improperly operate, which affects space temperatures.

13-4a.1 The 2PD thermostat, Detroit Switch 22100, has a four-inch diameter electrical enclosure base and a one and one half-inch diameter dial, with a scale of 40 to 90 degrees Fahrenheit. This is the most common thermostat used for shipboard A/C systems.

13-4a.2 The thermostat contains separate switches for heating and cooling, each with a differential of two degrees, and separated by a one-degree neutral zone. The internal contacts are interlocked so that they cannot both close at the same time, preventing the heating and cooling systems from operating simultaneously. The thermostat sends a 120-volt signal to actuate the chilled water solenoid valve, steam solenoid valve, or electric heater relay.

13-4a3 The thermostat is adjusted as follows:

- Fasten a thermometer near the thermostat to record ambient temperature. Allow time for the thermometer to stabilize at the ambient temperature.
- Loosen the thermostat dial locking screw (if not already loosened) using a 1/16 inch Allen wrench, so the dial is free to rotate.
- Do not touch the brass post in the center of the dial, as this is the temperature sensor.
- Turning the thermostat dial should produce four audible internal clicks (contacts opening and closing), two in each direction. Counterclockwise: first click, cooling contacts opening, second click, heating contacts closing. Clockwise: first click, heating contacts opening, second click, cooling contacts closing. The clicks should all be within a five-degree range on the dial.
- Turn the thermostat dial fully clockwise to 40 degrees.
- Slowly turn the dial counterclockwise until the first click (cooling contacts opening) is heard. If the click is heard, go to step h; if the click is not heard, go to step g.

- If the click is not present, loosen the two screws on the dial face; this will allow the post to move independently of the dial. To loosen the screws use needle nosed pliers, or preferably a screwdriver that has been machined with a 5/32-inch slot to fit the screws. Holding the dial stationary, rotate the post clockwise using a screwdriver until two clicks are heard, and then counterclockwise until one click is heard. If no clockwise clicks are heard, rotate the post to the first click. If no clicks are heard, rotate the post to the first click. If no clicks are heard, the thermostat is defective and should be replaced. The NSN is 1H 5930-00-726-4371.

- If the dial temperature indication of the first counterclockwise click is not the same as the temperature indicated on the thermometer, loosen the two screws on the dial face (if not previously accomplished) using the procedure in the previous step. Set the dial at the temperature indicated on the thermometer. Holding the dial stationary, reestablish the first counterclockwise click by turning brass post first clockwise and then counterclockwise to the first click. Tighten the screws on the dial face. The first counterclockwise click should be the ambient temperature for properly adjusted thermostats.

13-4a.4 The thermostat is now properly adjusted. Set the dial at the desired space temperature and tighten the dial locking screw. The space temperature should be automatically maintained.

13-4a.5 For the heating and cooling system to operate properly, all components must be operating correctly. These include the electrical control wiring, humidistat, chilled water solenoid valves, steam solenoid valves, and electric heater relays.

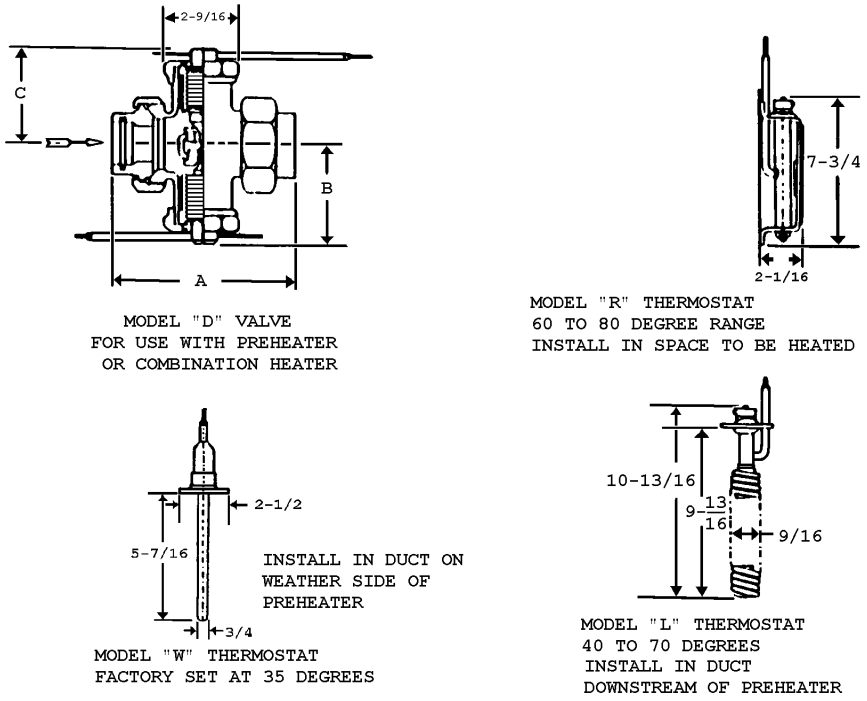


Figure 13-1 Temperature Regulating Valve Model "D"

PHYSICAL DATA										
VALVE SIZE NO.	STEAM CAPACITY (LBS PER HOUR)			DIMINSIONS (INCHES)				ORDERING DATA		
	DESIGN HTR CAP	WEA SIDE "W" THERMO	DOWN STREAM SIDE "L" THERMO	PIPE SIZE (IPS)	A	B	C	THERMO TYPE	COG	NSN 4820-00
D21		10	30	3/4	6.3125	346	346	L&W	1H	276-8960
								R&W	9C	276-8969
D22	55	15	40	3/4	6.3125	346	346	L&W	1H	276-8961
								R&W	1H	276-8970
D23	82	22	60	3/4	6.3125	346	346	L&W	1H	276-8962
								R&W	1H	276-8971
D24	120	30	90	1	6	346	346	L&W	1H	276-8963
								R&W	1H	276-8972
D25	160	40	120	1	6	346	346	L&W	9C	276-8964
								R&W	1H	276-8973
D26	220	60	160	1.25	6.90625	509	509	L&W	1H	276-8965
								R&W	1H	276-8974
D27	290	90	200	1.25	6.90625	509	509	L&W	9C	276-8966
								R&W	1H	276-8975
D28	350	90	260	1.5	7.4375	509	509	L&W	9C	276-8967
								R&W	9C	276-8976
D29	445	120	325	1.5	7.4375	509	509	L&W	1H	276-8968
								R&W	9C	276-8977

Table 13-2 Temperature Regulating Valve Model "D"

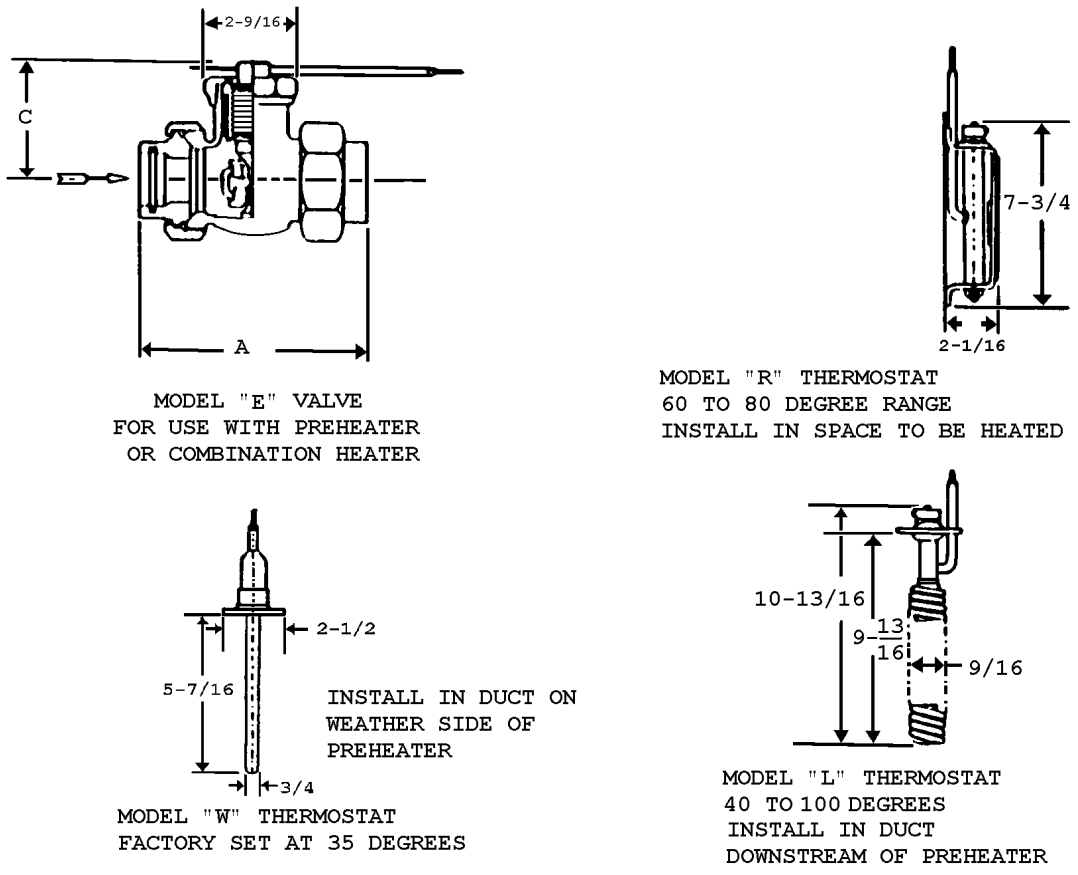


Figure 13-2 Temperature Regulating Valve Model "E"

PHYSICAL DATA						ORDERING DATA	
VALVE SIZE NO.	FACE AREA SQ FT	PIPE SIZE (IPS)	DIMENSIONS (INCHES) C	DIMENSIONS (INCHES) A	THERMO TYPE	COG	NSN 4820-00
E 1/2		1300			R	9C	276-8998
					L		276-
					W		276-
E 1	1000	1/2	332	690	R	1H	276-7864
					L		276-
					W		276-
E2	1500	1/2	332	690	R	1H	276-7865
					L		276-
					W		276-
E3	2200	1/2	332	690	R	1H	276-7866
					L	1H	276-8988
					W	9C	276-8978
E4	3000	1/2	332	631	R	1H	276-7867
					L	9C	276-8989
					W	1H	276-8979
E5	4000	1/2	332	631	R	9C	276-7868
					L	1H	276-8990
					W	9C	276-8980
E6	6000	1/2	332	631	R	1H	276-7869
					L	9C	276-8991
					W	1H	276-8981
E7	9000	1/2	332	600	R	1H	276-7870
					L	1H	276-8992
					W	1H	276-8982
E8	1 2000	1/2	332	600	R	1H	276-7871
					L	1H	276-8993
					W	9C	276-8983
E9	1 6000	1/2	301	640	R	9C	276-7872
					L	1H	276-8994
					W	1H	276-8984
E10	2 0000	1/2	303	640	R	1H	276-7873
					L	1H	276-8995
					W	1H	276-8985
E11	2 6000	1/2	303	646	R	1H	276-7874
					L	1H	276-8996
					W	9C	276-8986
E12	3 2500	1/2	303	646	R		
					L	9C	276-8997
					W	1H	276-8987

Table 13-3 Temperature Regulating Valve Model "E"

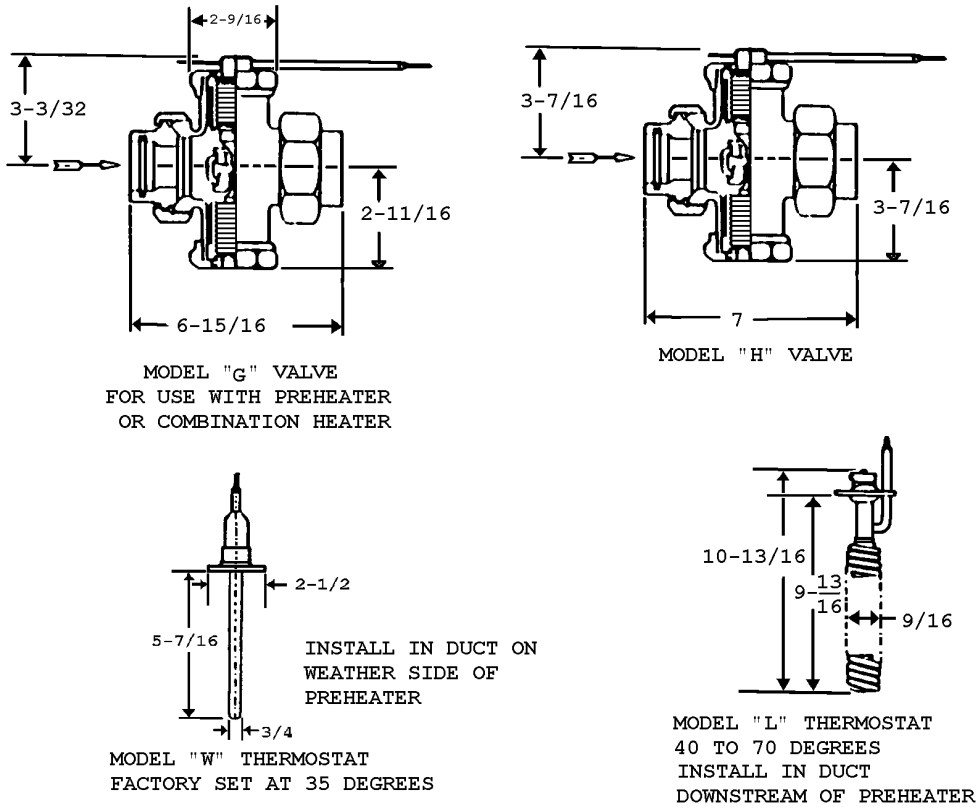


Figure 13-3 Temperature Regulating Valve Model "G" and "H"

PHYSICAL DATA				ORDERING DATA	
VALVE SIZE NO.	STEAM CAP LBS PER HR	PIPE SIZE (IPS)	THERMO TYPE	COG	NSN 4820-00
G 32	450	1-1/2	W	9C	276-8998
			L	1H	276-9001
G 33	600	1-1/2	W	9C	276-8999
			L	1H	276-9002
G 34	900	1-1/2	W	1H	276-9000
			L	1H	276-9003
H 41	1400	2	L		
H 42	2000	2	L		
H 43	2700	2	L	1H	276-9004

Table 13-4 Temperature Regulating Valve Model "G" and "H"

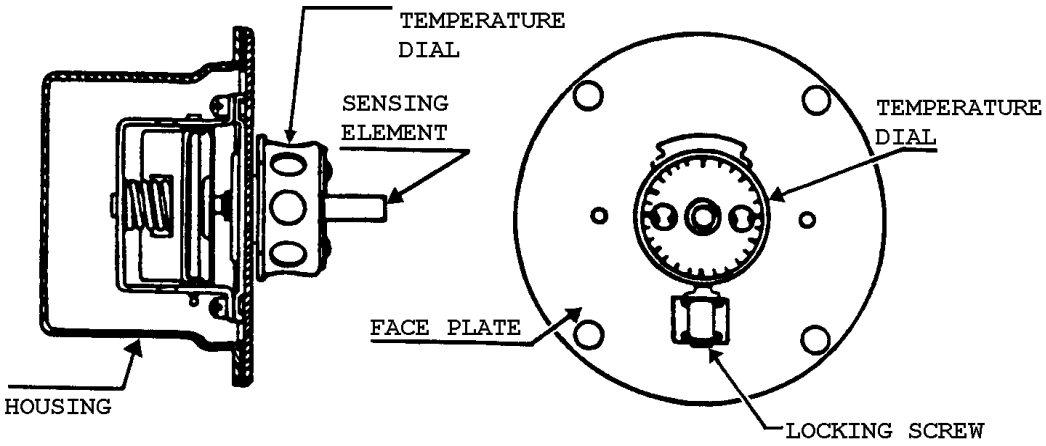


Figure 13-4 Two Position Dual Thermostat

MFR NO.	ORDERING DATA	
	COG	NSN 5930-00
TS-1617	9N	726-4371

Table 13-5 Two Position Dual Thermostat

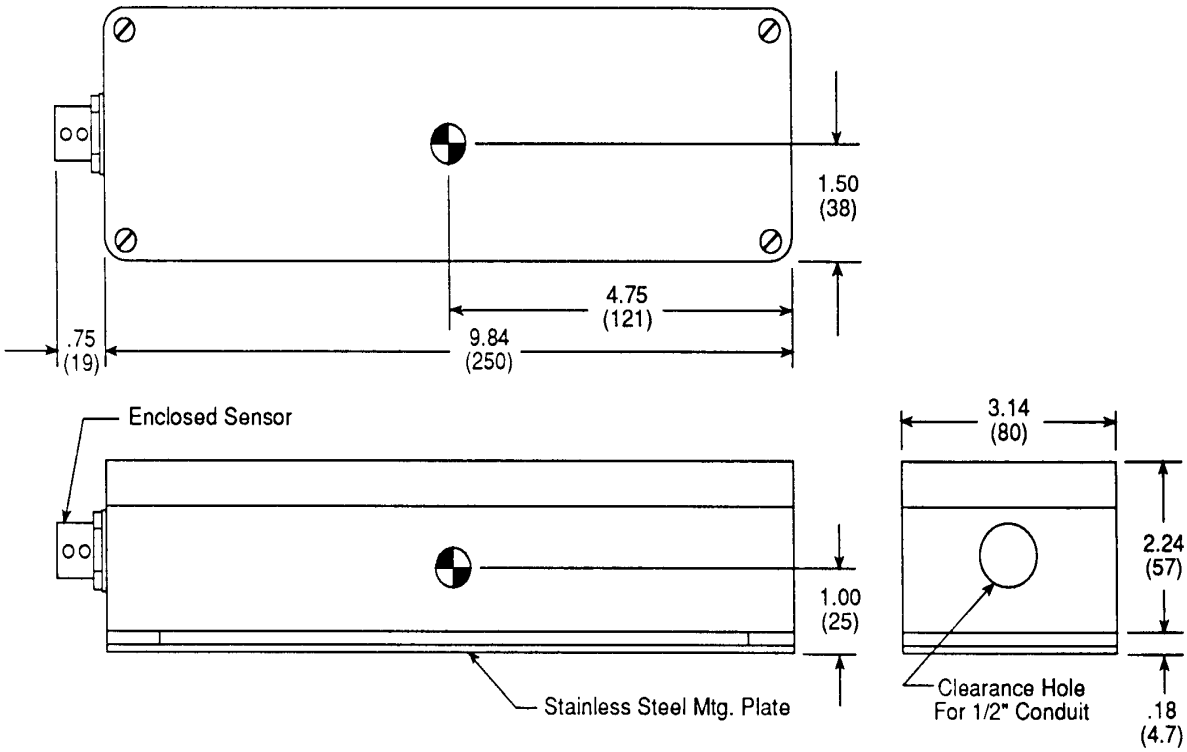


Figure 13-5 Electronic Two Position Dual Thermostat

Tech Manual #T9511-A6-MMC-010

MFR NO.		ORDERING DATA	
	APL	COG	NSN
11110	21A030019	9N	5930-01-436-1185
11120	21A030020	9N	5930-01-435-8137
11130	21A030021	9N	5930-01-372-6736
11140	21A030022	9N	5930-01-372-6734

Table 13-6 Electronic Two Position Dual Thermostat

13-5a E2PD Jumper Setting Instruction

13-5a.1 Controls and Indicators. The E2PD controller operates automatically to maintain temperature at a desired temperature set point.

13-5a.2 The temperature set point is selected during installation based on the desired ambient temperature. Selection is made by cutting the Control Point Jumper Module (shown in Figure 13-6. The set point is compared to the actual temperature sensed by the temperature sensor, and the controller regulates the heating or cooling requirement accordingly.

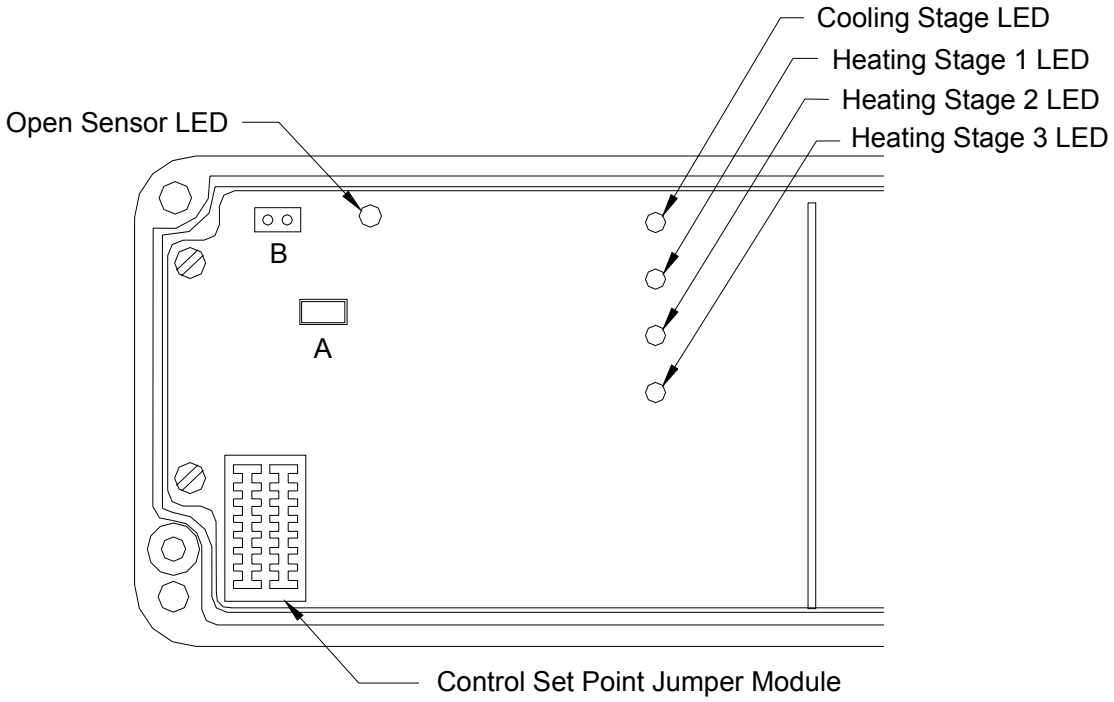


Figure 13-6 Controls and Indicators

13-5a.3 The E2PD controller contains the following light emitting diode (LED) indicators:

Indication for:	**LED Color:**
Heating Stage 1 ON	Yellow
Heating Stage 2 ON	Yellow
Heating Stage 3 ON	Yellow
Cooling ON	Green
Open Sensor	Red

13-5a.4 There are seven (7) jumpers on each side of the jumper module that can be cut to set the control temperature. Cutting a jumper will increase the control temperature by the amount shown in Figure 13-7.

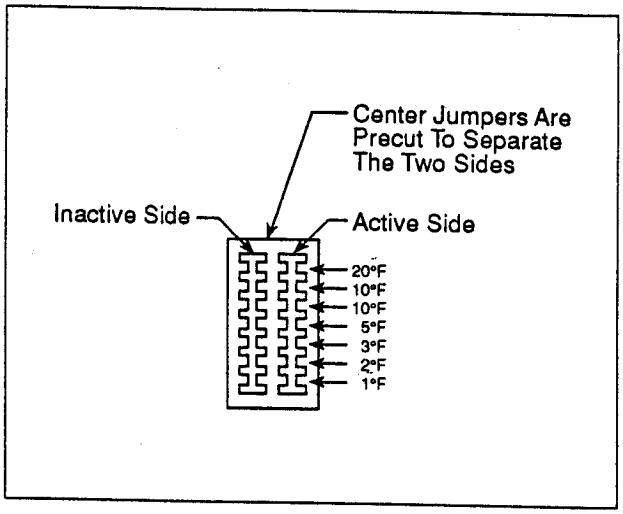


Figure 13-7 Cut Jumpers to increase control temperature

13-5a.5 Temperature Band Selection. Two temperature control bands are available on each thermostat. Position A (refer to Figure 13-8) has a 1°F value. When the temperature band jumper is 1°F setting, the contactors and solenoids will switch more frequently, giving the tightest temperature control.

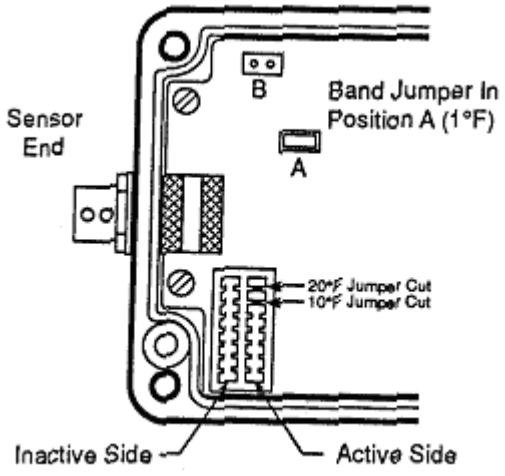


Figure 13-8 1°F Band Setting and 70°F Set Point

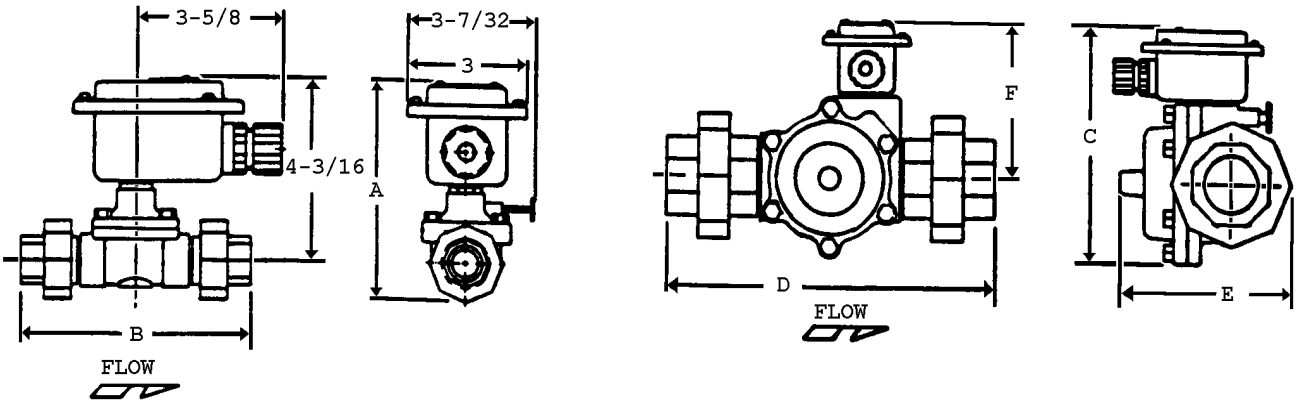


Figure 13-9 Two Way Chilled Water Solenoid Valve

PHYSICAL DATA										ORDERING DATA		
PIPE SIZE (INS)	ORIFICE SIZE (INS)	MIN/MAX OR PRESS DIFF (PSI)	FLOW FACTOR	DIMENSIONS (INCHES)						COG	APL	NSN 4810-00- *4810-01-
				A	B	C	D	E	F			
1/2	11/16	0/100	3.6	5-9/32	6						882182475	*088-2876
3/4	11/16	0/100	6	5-1/2	7-9/16					9C	882182449	007-4738
1	1	5/100	13			6-13/32	8-15/16	3-1/2	4-41/64	9C	882182459	127-9302
1-1/4	1-1/8	5/100	15			6-13/32	9-1/2	4-1/32	4-41/64	9C	882182533	307-8384
1-1/2	1-1/8	5/100	22.5			6-7/8	10-5/8	4-1/2	4-51/64	9C	882182482	201-8732
2	1-3/4	5/100	44			8-1/32	12-1/32	6-7/32	5-13/64		882183101	*122-0997

Table 13-7 Two Way Chilled Water Solenoid Valve

13-5 Solenoid Valve

13-5a Chilled water solenoid valve

Two way chilled water solenoid valves have also frequently been the cause of air conditioning system problems. The manual operator star thumb wheel on one inch and larger pilot operated valves should be turned fully clockwise for automatic operation. The knurled thumb wheel on ½ and ¾ inch valves should be in the counterclockwise position for automatic operation. If the thumbwheel is not in the automatic position, the valve will always be open. Even with the manual operation in the proper position, the valve may still be stuck open due to dirty valve internals. Refer to Figure 13-6 and Table 13-7 and 13-8 for details and repair parts.

VALVE PART NO.	SIZE	VALVE NSN	REBUILD KIT NO.	REBUILD KIT NSN	REMARKS
AV160-700-7	1/2	4810-01-088-2876	FV214-681	4810-01-258-2249	SEE NOTE 1
AV160-700-9	1/2	4810-01-142-3961	FV214-952	4810-01-335-7323	SEE NOTE 3
AV160-700-11	1/2	4810-01-328-6275	FV214-681	4810-01-258-2249	SEE NOTE 2
AV160-700-8	3/4	4810-00-007-4738	FV214-681	4810-01-258-2249	SEE NOTE 1
AV160-700-10	3/4	NA	FV216-382	4810-01-335-7325	SEE NOTE 3
AV160-700-12	3/4	4810-01-337-3897	FV214-681	4810-01-258-2249	SEE NOTE 2
AV174-360-10	1	4810-00-127-9302	FV214-682	4810-01-304-7442	SEE NOTE 1
AV174-360-13	1	4810-01-313-7633	FV216-381	4810-01-142-3980	SEE NOTE 3
AV174-360-16	1	4810-01-305-2021	FV214-682	4810-01-304-7442	SEE NOTE 2
AV174-360-11	1-1/4	4810-00-307-8384	FV214-682	4810-01-304-7442	SEE NOTE 1
AV174-360-14	1-1/4	4810-01-154-1236	FV214-383	NA	SEE NOTE 3
AV174-360-17	1-1/4	4810-01-139-1655	FV214-682	4810-01-304-7442	SEE NOTE 2
AV174-360-12	1-1/2	4810-00-201-8732	FV214-892	4810-01-314-8777	SEE NOTE 1
AV174-360-15	1-1/2	4810-01-145-5513	FV216-380	4810-01-142-7456	SEE NOTE 3
AV174-360-18	1-1/2	4810-01-314-2516	FV214-892	4810-01-314-8777	SEE NOTE 2
AV228-763-1	2	4810-01-122-0997	FV310-561	4810-01-305-5717	SEE NOTE 1
AV228-763-2	2	4810-01-220-9816	FV310-562	4810-01-316-0143	SEE NOTE 3
AV228-763-3	2	4810-01-357-8688	FV310-561	4810-01-305-5717	SEE NOTE 2

Table 13-8 Two Way Chilled Water Solenoid Valve Rebuild Kit

NOTE 1 SIL-BRAZE UNION WITH TAILPIECE BRAZING RING
NOTE 2 SIL-BRAZE UNION WITHOUT TAILPIECE BRAZING RING
NOTE 3 SIL-BRAZE UNION WITHOUT TAILPIECE BRAZING RING BUT WITH 0-RING & BRONZE SPACER

13-5b Steam Solenoid Valve

Two way steam solenoid valves are used to control steam to reheaters and are controlled by a 2PD thermostat or E2PD thermostat. Refer to Figure 13-7 and Table 13-9 for details.

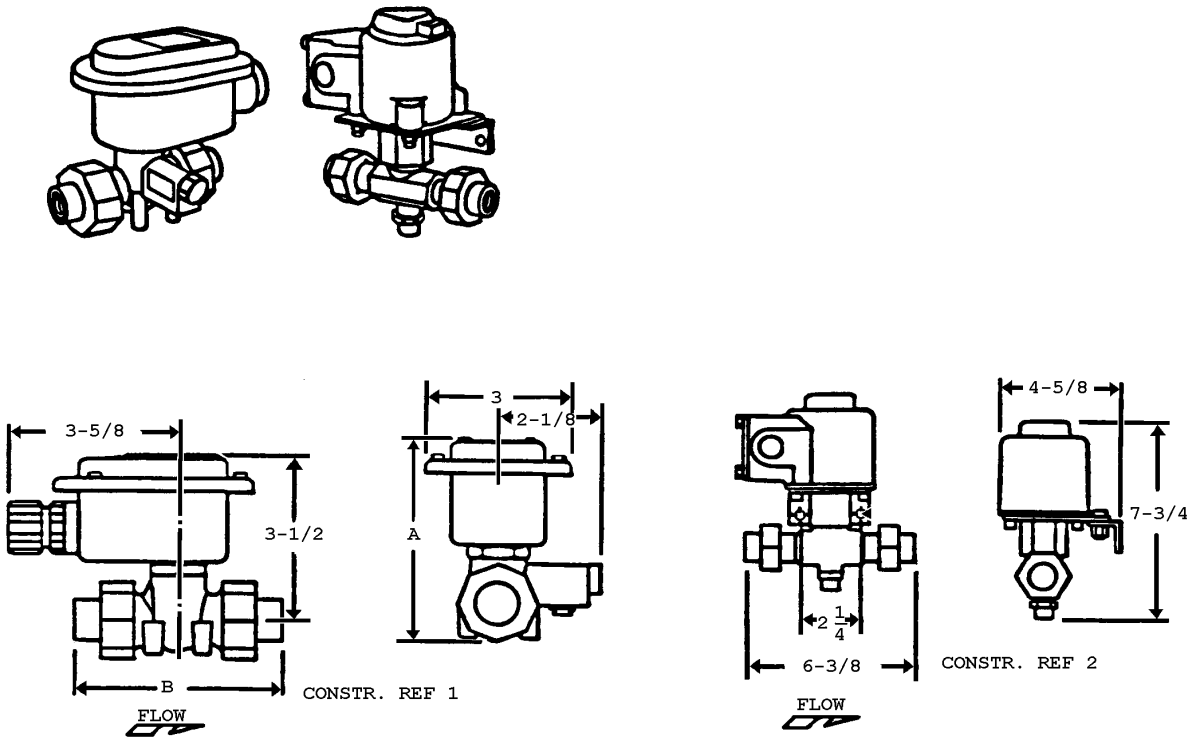


Figure 13-10 Two Way Steam Solenoid Valve

PHYSICAL DATA							ORDERING DATA		
PIPE SIZE (INS)	ORIFICE SIZE (INS)	MIN OPG PRESS DIFF (PSI)	MAX OPG PRESS DIFF (PSI)	MAX STEAM FLOW LBS/HR	FLOW FACTOR	CONSTR FACTOR	COG	APL	NSN 4810-00- *4810-01-
1/2	1/16	0	50	500	.08	100	9C	882182529	297-2024
	5/64	0	50	1000	.16				
	3/32	0	50	1500	.23	100	9C	882182789	*145-5515
	1/8	0	50	2200	.35	100	9C	882182790	*146-6988
	5/32	0	50	3000	.47	100	9C	882183571	*215-4281
	3/16	0	50	4000	.63	100	9C	882181492	262-1162
	15/64	0	50	6000	.95	200	9C	882180850	064-5913
	5/16	0	50	9000	1.42	200	9C	882180851	990-1877
	11/32	0	50	1 0000	1.58	200	9C	882181021	914-2227

Table 13-9 Two Way Steam Solenoid Valve

Chapter 14

XIV - VENTILATION INSULATION

General knowledge of commonly used insulation for HVAC systems.

14-1 INTRODUCTION

There are two types of insulation commonly used on ventilation ductwork on aircraft carriers; thermal insulation, and acoustic insulation, refer to Figure 14-1.

14-1a Thermal Insulation

Thermal insulation is provided for systems when the temperature differential between the space and duct air may allow condensation to form on the ductwork. A temperature differential of 3° from the air inside of the duct to that of the air outside the duct can allow condensation to start to form. Thermal insulation is also provided for heaters when required for safety of operating personnel.

14-1b Acoustic Insulation

Acoustic insulation or sound dampening insulation is used where required in systems serving, or passing through, noise category spaces to reduce excessive airborne noise caused by fans, mechanical vibration, and air movement. The materials used to absorb the noise are faced fiberglass insulation (with perforations) or unfaced insulation covered by a perforated aluminum sheet. The fiberglass absorbs noise and reduces the transmission of both noise and heat through the duct walls.

NOTE

Where both thermal insulation and acoustic absorptive treatment are necessary, acoustic absorptive treatment only shall be installed.

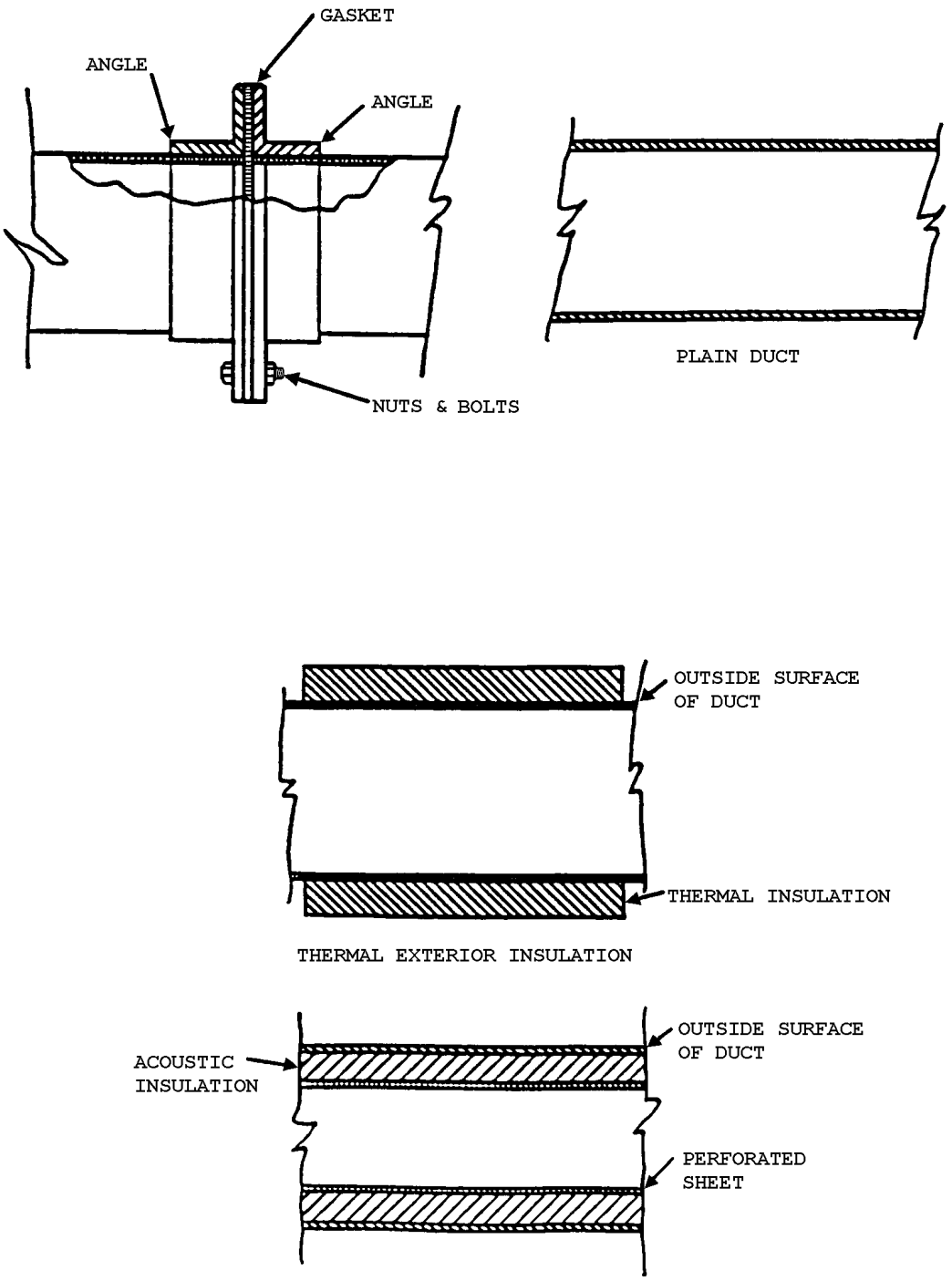


Figure 14-1 Ductwork Insulation

Chapter 15

XV - AIR CONDITIONING BOUNDARY DOORS

General knowledge of boundary doors that affect HVAC systems.

15-1 INTRODUCTION

Classified structural doors should not be used as A/C boundary doors. Metal joiner doors are designed to be used as A/C boundary doors, refer to Figure 15-1. Where an A/C boundary door is required, and a structural door is installed, a joiner door should be installed adjacent to the structural door, refer to Figure 15-1.

15-2 REQUIREMENTS

Joiner doors are used to provide passage between air conditioned and non-air conditioned areas. Joiner doors shall be without coamings, except where the doors are located in structural bulkheads. Joiner doors without coamings shall have sills high enough to allow a minimum clearance of 1/2 inch between the bottom of the door and the deck covering throughout the arc of the swing of the door. Joiner doors shall be of aluminum alloy. Fixed lights, 4 inches in diameter, shall be provided to spaces where additional visibility is necessary because of traffic considerations. Air conditioning boundary doors shall be fitted with a door closer, Fed. Spec. FF-H-121. A/C boundary doors shall be provided with hook and bumper devices for holding the door fully open. Bumpers shall be located to strike the door in an area backed by the doorframe.

15-2a Installation

Joiner doors shall be installed in the following locations:

15-2a.1 Passageways leading from weather access door to an air conditioned area.

15-2a.2 Access doors to air conditioned spaces opening into a ventilated passageway.

15-2a.3 Passageways or access hatches leading from a ventilated area to an air conditioned area, except where there is an airflow from the air conditioned area to the ventilated area.

15-3 ORDERING DATA FOR METAL JOINER DOORS INTENDED FOR USE AS A/C BOUNDARIES

There are many configurations of metal joiner doors; however, only a few are regularly used as A/C boundaries. They are, by type, "A", "D", "G", "H" and "HS", refer to Figures 15-2 thru 15-5. These doors are manufactured for AIRPAC at the Puget Sound Naval Shipyard (PSNS) and for AIRLANT at the Norfolk Naval Shipyard (NNSY).

15-3a Points of Contact

The point of contact for Puget Sound Naval Shipyard is Phill Moncrief, Code 1212, DSN 439-1967 or commercial (360) 476-1967 or e-mail moncriefp@psns.navy.mil. The point of contact for FTSCLANT is Code N434C, Ted Futscher DSN 564-7281 or com (757) 444-7281 or e-mail n434c_at_postof43@fmso.navy.mil.

15-3b Ordering Instructions

Metal joiner doors shall be ordered on one of the following forms. Project Order (NAVCOMPT Form 2053), Work Request (NAVCOMPT Form 140), or Requisition (Std Form DD 1149). In extreme urgency, doors may be ordered by Naval Message.

15-3c Definitions

The following definitions are provided to assure proper communications between the Shipyard and the Ship.

15-3c.1 Left Hand Door (LH). The hinges are on the left hand side of the door, with the door swinging toward the operator.

15-3c.2 Right Hand Door (RH). The hinges are on the right hand side of the door, with the door swinging toward the operator.

15-3c.3 Clear Opening. The unobstructed opening through which passage is permitted. This opening is measured as the width and height on the inside of the doorframe. Do not measure the door, just the clear opening.

NOTE

Sixty-six inch doors are intended for use with sill raised nine inches above deck.

15-3d Required Accessories

All Boundary Doors must have the following items installed refer to Figure 15-6.

15-3d.1 Latch Set. There must be a non locking latch bolt that is operated by a knob from either side at all times (Fed. Spec. Type 161N-4).

15-3d.2 Door Closer. There must be a hydraulic door closer to automatically close the door.

15-3d.3 Rubber Gasket. A gasket is required to make the door fume-tight.

15-3d.4 Hook and Bumper. There must be a tie back device to secure the door in an open position.

***NOTE**: Items 1, 2, and 3 come with door, BUT must be called out in request.*

Item 4 is an NSN item and must be ordered separately.

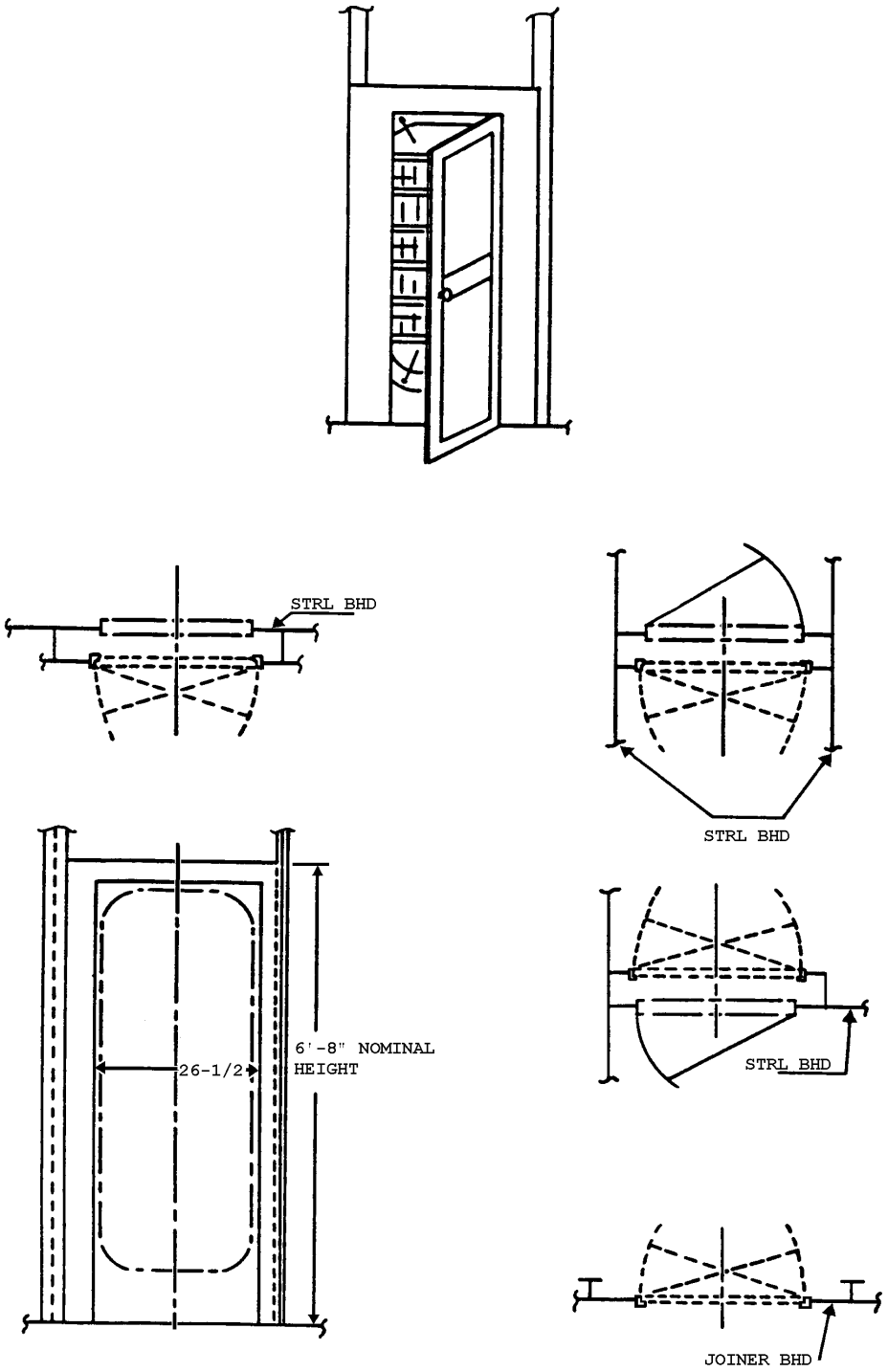


Figure 15-1 Typical A\C Boundary Door Arrangements METAL JOINER DOOR TYPE "HS"

The door as illustrated includes the following:

(1) door, (1) frame, (4) 3-1/2 brass hinges, (2) rubber bumpers, and (1) type 161T-4 locket set with (2) keys.

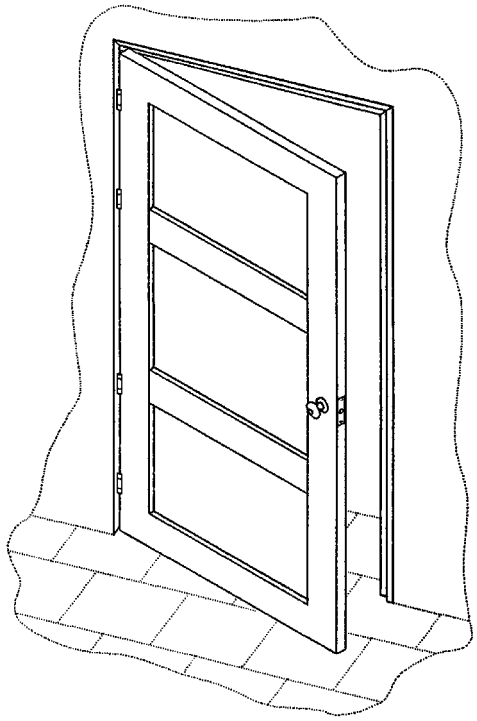


Figure 15-2 Metal Joiner Door Type "HS"

See drawing 805-2217402 for details.

TYPE	SIZE	SILL	SYMBOL
HS-RH	36 X 75-11/16	NONE	HS402-1
HS-LH	36 X 75-11/16	NONE	HS402-2

The door as illustrated includes the following:

(1) door, (1) frame, (2) 3-1/2 brass hinges, (2) rubber bumpers, (1) sill, and (1) type 161T-4 locket set with (2) keys.

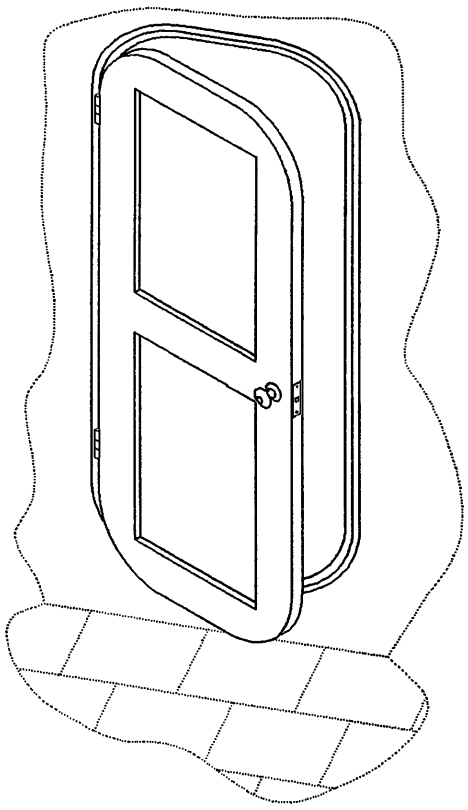


Figure 15-3 Metal Joiner Door Type "A & H"

See drawing 805-1642752 and 805-1642434 for details.

TYPE	SIZE	SILL	SYMBOL
A-RH	26 X 66	EXT ALUM	A752-1
A-LH	26 X 66	EXT ALUM	A752-2
H-RH	26 X 74	STL CHAN	R434-1
H-LH	26 X 74	STL CHAN	R434-2

The door as illustrated includes the following:

(1) door, (1) frame, (4) 3-1/2 brass hinges, (2) rubber bumpers, and (1) type 161T-4 locket set with (2) keys.

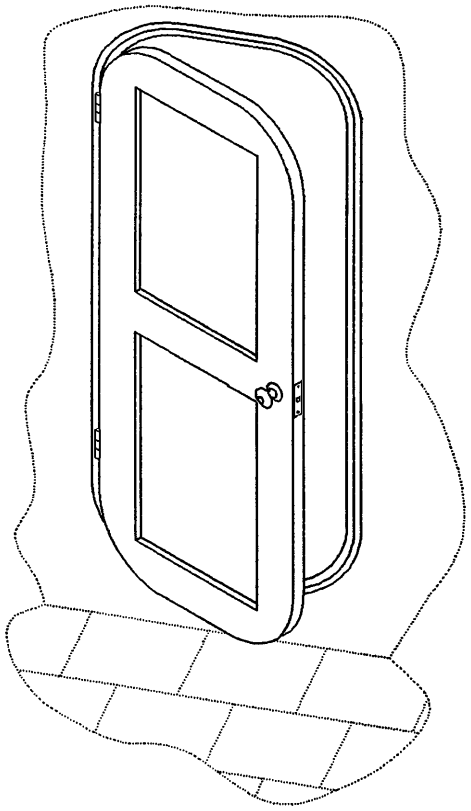


Figure 15-4 Metal Joiner Door Type "D"

See drawing 805-1648655 for details.

TYPE	SIZE	SILL	SYMBOL
D-RH	26 X 66	EXTRUSION	D655-1
D-LH	27 X 66	EXTRUSION	D655-2

The door as illustrated includes the following:

(1) door, (1) frame, (2) 3-1/2 brass hinges, (2) rubber bumpers, and (1) type 161T-4 locket set with (2) keys.

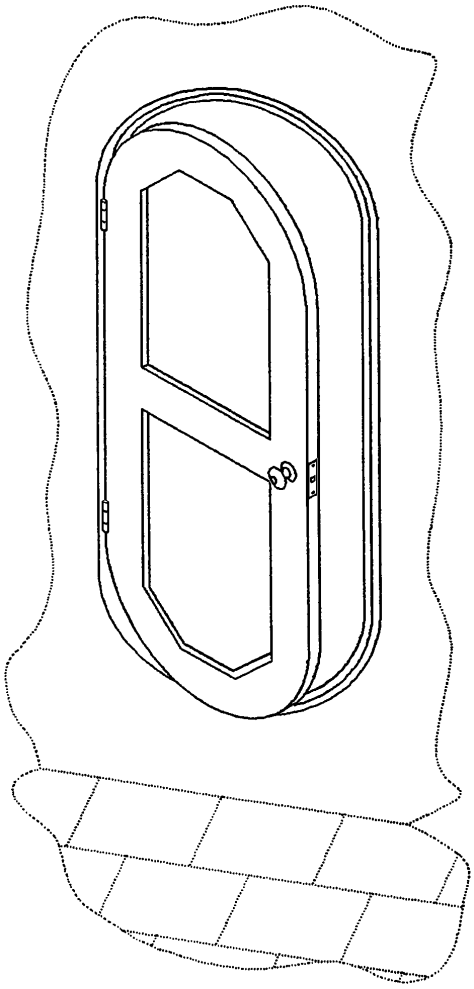
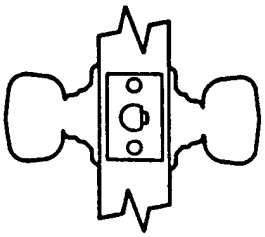


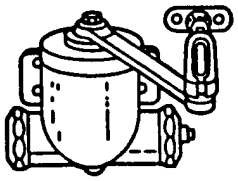
Figure 15-5 Metal Joiner Door Type "G"

See drawing 805-1643218 for details.

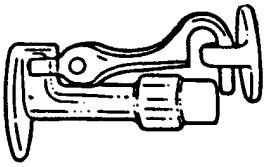
TYPE	SIZE	SILL	SYMBOL
G-RH	26 X 66	EXTRUSION	G218-3
G-LH	27 X 66	EXTRUSION	G218-4



Lockset, Fed. Spec. Type 161-N4, for passage doors that do not require locking. Latch bolt is operated by a knob from either side at all times.



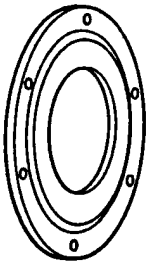
Closer, door, hydraulic-Door closer shall be fitted on doors to all air conditioned spaces, on doors to water closets and washrooms, on doors affording principal access to or passage wardroom, and on other doors in constant general use. Door closer is shipped loose with door and must be installed by requester.



Door stop hook and bumper.

(NSN 5340-00-369-5013)

Gasket, rubber, door, fumetight- Use on doors to be installed in fumetight spaces such as water closets, washrooms, and air conditioned spaces.



Fixed light, 4" diameter glass-Fixed lights shall be provided in doors to workshops and other spaces where additional visibility is necessary because of traffic considerations.

Figure 15-6 Door Accessories

Chapter 16

XVI - ACCESSORIES

Accessories required to support HVAC systems.

16-1 INTRODUCTION

There are various accessories that support ventilation systems. Described in this Chapter are chilled water flow control/balance valves, ventilation valves and Navy Standard bellmouth intakes.

16-2 AUTOMATIC FLOW CONTROL/BALANCE VALVE

The air conditionings chilled water automatic flow control/balance valve, (refer to Figure 16-1 and Table 16-6A thru 16-E) control the predetermined flow rate through a cooling coil. This flow control/balancing valve permits operational zones or cooling coils to remain in service even though many others may have been inactivated due to battle damage. As the system is modified and other cooling coils are added to the system the automatic control/balance valve maintains proper system balance without a major re-balancing effort. The control/balance valve is usually installed in the cooling coil chilled water outlet/return piping, refer to Figure 8-1.

Figure 16-1 Automatic Flow Control/Balance Valve

16-3 BOLTS, NUTS, AND GASKET MATERIAL

During HVAC system maintenance rubber gaskets on ducting and fan flanges may be torn, bolts are sometimes broken. Both the bolts and gaskets have to be replaced. See Table 16-1 for ordering data for gasket material. See Table 16-2 for ordering data for bolts and nuts.

SIZE	C O G	N S N	UI
1/16"	9Z	5330-00-244-9276	SY
1/8"	9Z	5330-00-244-9277	SY
1/8"	9Z	5330-00-179-0052	SY
3/16"	9Z	5330-00-244-9278	SY
1/4"	9Z	5330-00-179-0054	SY

Table 16-1. Ordering Data for Gasket Material (Ducting and Fan Flanges)

SIZE	C O G	N S N	UI
1/4"-20 X 7/8"	9Z	5305-00-225-3840	HD
5/16" X 1-1/4"	9Z	5305-00-282-9649	EA
3/8" X 2"	9Z	5305-00-174-4033	EA
3/8" X 1-1/2"	9Z	5305-00-174-4032	EA

SIZE	C O G	N S N	UI
1/4"-20	9Q	5310-00-761-6882	HD
5/16"-18	9Z	5310-00-194-8195	EA
3/8"-16	9Z	5310-00-732-0558	HD

Table 16-2. Ordering Data for Bolts and Nuts (Ducting and Fan Flanges)

16-4 VENTILATION VALVES

The type "R" and type "K" ventilation valves can be operated to close off airflow through ventilation ducting, refer to Figure 16-2 and 16-3. The type "R" and type "K" ventilation valves are installed in ventilation ducting as close to the penetration as possible. These valves are sometimes installed with extension stems or remote operating gear. Ordering information for type "R" and "K" valves in Table 16-3 and 16-4 is for steel "fire safe" valves. For detailed information on steel "fire safe" "R" valves see Navy Std. Drawing. No. 804-1749102-C. For steel "fire safe" "K" valves see Navy Std. Dwg. No.804-1749103-C.

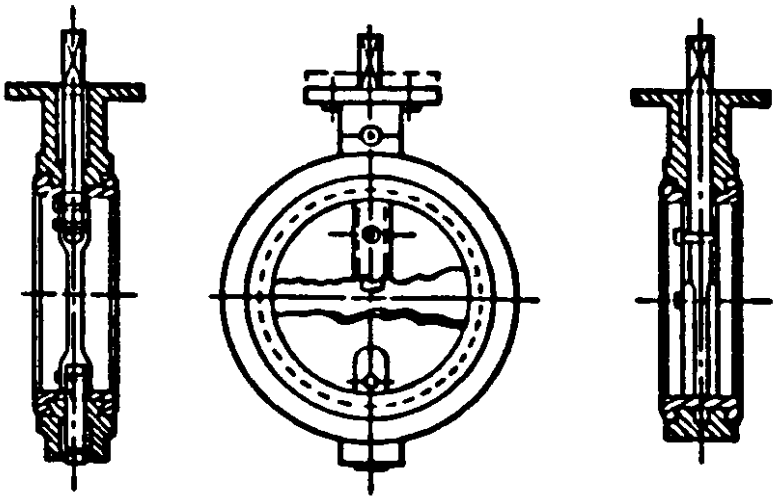


Figure 16-2 Type “R” Round Ventilation Valve

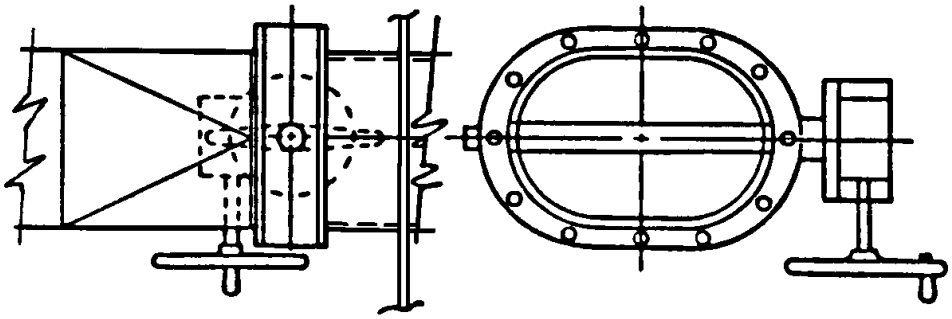


Figure 16-3 Type “K” Flat Oval Ventilation Valve

ORDERING DATA		
SIZE	**COG**	**NSN 4820-01**
+ R2 ½	3H	319-0029
+ R3	3H	320-2818
+ R3 ½	3H	319-0030
+ R4	3H	319-0031
+R5	3H	319-0032
+R6	3H	319-0033
R8	3H	319-0034
R10	3H	319-0035
R12	3H	354-2574
R14	3H	279-7234
R16	3H	354-2575
R18	3H	326-3569
R20	3H	297-5937
R24	3H	279-1713
+R2-1/2 THROUGH R10 COME WITHOUT A HANDLE OR OPERATING GEAR. LEVER HANDLE ASSEMBLY FOR R2-1/2 THROUGH R6 IS COG 1H, NSN 4820-00-752-9721.		
WORM GEAR OPERATOR FOR R2-1/2 THROUGH R6 IS COG 9C, NSN 4820-00-752-9722, (HAS A 5/8" HOLE AND IS 20:1 RATIO). R8 THROUGH R18 COME WITH OPERATOR GEAR.		

Table 16-3 Type "R" Ventilation Valve

ORDERING DATA			
MODEL NO.	**SIZE**	**COG**	**NSN 4820-01**
K31	7 X 3	3H	317-3537
K32	8 X 4	3H	319-0051
K33	9 X 5	3H	279-1714
K34	11 X 6	3H	354-2579
K35	13 X 7	3H	354-2576
K36	16 X 8	3H	354-2571
K37	20 X 9	3H	354-2580
K38	24 X 10	3H	279-7228
K39	24 X 15	3H	288-7188
K40	30 X 16	3H	297-5944
K41	30 X 20	9C	331-6804
THESE VALVES NORMALLY COME WITH GEAR OPERATOR AND HANDLE K31 - K34 VALVE OPERATOR IS COG 9C, NSN 4820-00-752-9722			

Table 16-4 Type "K" Ventilation Valve

16-5 NAVY STANDARD BELLMOUTH INTAKE

The Navy Standard Bellmouth is installed on the inlet to a vane axial fan when the fan takes suction from a plenum, compartment or trunk that is much larger than the fan intake. Bellmouth intakes reduce system pressure loss, turbulence, and noise and equalize airflow over the inlet face of the fan, refer to Figure 16-4 and Table 16-5. Navy Standard Bellmouths are designed to fit Navy Standard Vane Axial fans and therefore have the same size numbers.

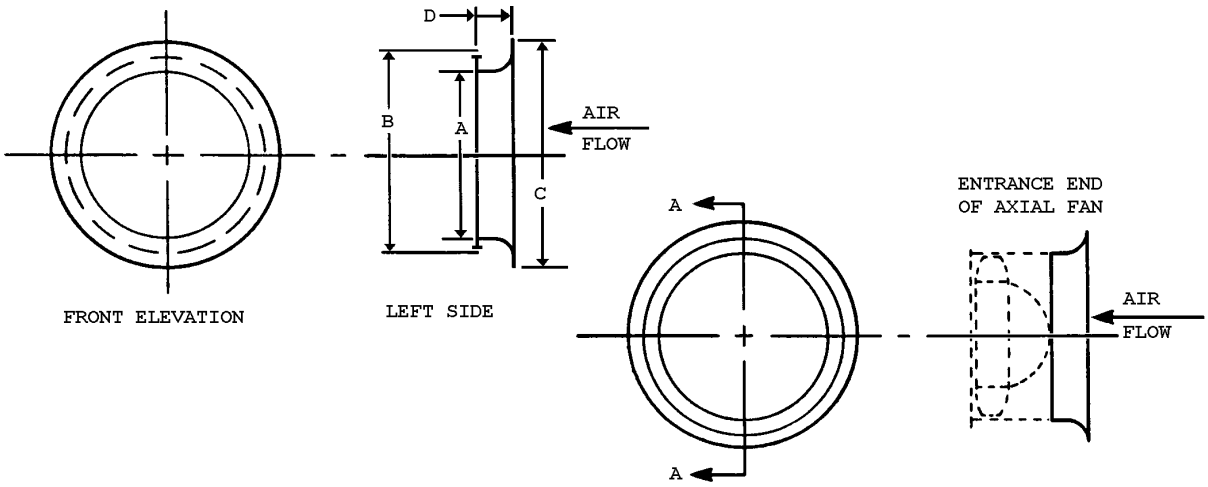


Figure 16-4 Bellmouth Intake Terminal

PHYSICAL DATA						
	DIMENSIONS (INCHES)				ORDERING DATA	
SIZE	A	B	C	D	COG	NSN 2040-00
A 1/4	9.75	12.75	12.5	2	1H	396-1670
A 1/2	10.5	13.25	13.5	2	9G	396-1671
A 1	12.75	16	16.125	2.5	9G	396-1672
A 1 1/2	14.25	17.5	17.75	2.5	9G	396-1673
A 2	22.625	16.5	13.5	19.625	1H	396-1674
A 2 1/2	15.5	18.9375	19.25	3		
A 3	21.25	25.625	27.25	4	9G	396-1675
A 3 1/2	22.125	23.8125	28.25	4.5		
A 4	22.25	25.875	28.5	4.5	9G	396-1676
A 4 1/2	18	21.25	21.625	3.5	1H	396-1677
A 5	23.25	26.5625	29.25	5	9G	396-1678
A 6	25.25	28.625	32.25	5		
A 8	27.25	30.5625	35	5.5	9G	396-1681
A 10/A 12	29.25	32.59375	37.5	5.5	9G	396-1682
A 11/A 16	31.25	35.5625	40.125	6	1H	396-1683
A 17	34.25	38.3125	42.875	6.25		
A 20/A 28	36	39.4375	46	6.5		
A 25	42.25	46.875	54.25	8		
A 30	44.25	48.875	56.75	8.5		

Table 16-5 Bellmouth Intake Terminal

16-6 ACCESS OPENINGS

In order to permit inspection and cleaning of components and interior duct surfaces, access openings are provided as follows:

1. On each side of duct heaters
2. On each side of cooling coils (except when mounted directly to filter housing).
3. On the air outlet side of flame arresters
4. On the inlet side of vane turns and splitters
5. At the impeller end of axial fans
6. In exhaust ducts serving the laundry, galley, scullery, oxygen/nitrogen producing rooms and machinery spaces.

Access openings may consist of removable sections of duct or removable access covers.

16-7 ACCESS COVERS

Access covers consist of bolted plates and/or quick opening access covers for inspection. Quick opening access covers are shown in Figures 16-5, 16-6 and 16-7, Table 16-7, 16-8, 16-9, and 16-10.

1/2" UNION END				
SIZE GPM	**MFG NO.**	**COG**	**NSN 4820-00 *4820-01**	**REPAIR KIT NO. 5861-**
1/2	2354-1021	9C	058-7263	1SK
3/4	2354-1031	9C	*215-1579	14SK
1	2354-1041	9C	943-4021	2SK
1-1/2	2354-1061	9C	913-4711	3SK
2	2354-1081	9C	913-4713	4SK
2-1/2	2354-1091	9C	756-7555	5SK
3	2354-1101	9C	950-2262	6SK
3-1/2	2354-1111	9C	124-5637	7SK
4	2354-1121	9C	756-7559	8SK
4-1/2	2354-1131	9C	*180-0932	8ASK
5	2354-1141	9C	355-7695	9SK
6	2354-1151	9C	*073-5856	10SK
7	2354-1161	9C	*058-4145	11SK
8	2354-1171	9C	*067-9922	12SK
9	2354-1181	9C	*057-3811	13SK
10	2354-1191	9C	*085-9210	15SK

Table 16-6A ½" Union Flow Control/Balance Valve

3/4" UNION ENDS				
SIZE GPM	**MFG NO.**	**COG**	**NSN 4820-00 *4820-01**	**REPAIR KIT NO. 5862-**
3	2351-1101	9C	733-9026	7SK
3 ½	2351-1111	9C	308-7204	1SK
4	2351-1121	9C	*114-3905	2SK
5	2351-1141	9C	756-7554	3SK
6	2351-1151	9C	*113-1820	4SK
7	2351-1161	9C	*151-5630	5SK
8	2351-1171	9C	*124-8219	6SK
9	2351-1181	9C	326-6980	8SK
10	2351-1191	9C	*086-8688	9SK

Table 16-6B ¾" Union Flow Control/Balance Valve

1" UNION END				
SIZE GPM	**MFG NO.**	**COG**	**NSN 4820-00 *4820-01**	**REPAIR KIT NO. 5863-**
6	2352-1151	9C	*080-1914	15SK
8	2352-1171	9C	913-4716	1SK
9	2352-1181	9C	*093-0865	2SK
10	2352-1191	9C	756-7557	3SK
11	2352-1201	9C	*086-5758	4SK
12	2352-1211	9C	*067-8262	5SK
13	2352-1221	9C	*086-5762	6SK
14	2352-1231	9C	*093-0666	7SK
15	2352-1241	9C	913-4715	8SK
16	2352-1251	9C	*093-0859	9SK
17	2352-1261	9C	*086-5759	10SK
18	2352-1261	9C	*093-0858	11SK
19	2352-1281	9C	*162-0141	12SK
20	2352-1291	9C	*113-4883	20SK

Table 16-6C 1" Union Flow Control/Balance Valve

1 ½ UNION WITH 1 1/4 BODY				
SIZE GPM	**MFG NO.**	**COG**	**NSN 4820-01**	**REPAIR KIT NO. 5865-**
18	2353-1271			1SK
19	2353-1281			2SK
20	2353-1291			3SK
21	2353-1301			4SK
22	2353-1311			5SK
23	2353-1312	9C	256-5156	6SK
24	2353-1321			7SK
25	2353-1322	9C	129-1310	8SK
26	2353-1331			9SK
27	2353-1332			10SK
28	2353-1341	9C	114-1964	11SK
29	2353-1342	9C	149-1846	12SK
30	2353-1351			13SK
31	2353-1352	9C	307-9330	14SK
32	2353-1361	9C	308-8302	15SK
33	2353-1362	9C	310-1759	16SK
34	2353-1371			17SK
35	2353-1372			18SK
36	2353-1381			19SK
37	2353-1382	9C	373-7073	20SK
38	2353-1391			21SK
39	2353-1392	9C	128-8856	22SK
40	2353-1401	9C	308-5244	23SK
41	2353-1402	9C	111-1401	24SK
42	2353-1411	9C	111-1401	25SK
43	2353-1412	9C	373-3407	26SK
44	2353-1421	9C	373-7073	27SK
45	2353-1422	9C	395-8726	28SK
46	2353-1431	9C	186-8687	29SK
47	2353-1432			30SK
48	2353-1441	9C	186-3576	31SK
49	2353-1442	9C	187-1179	32SK
50	2353-1451	9C	187-1180	33SK

Table 16-6D 1-½" Union Flow Control/Balance Valve With 1 ¼" Body

1 ½ UNION END WITH 1 ½ BODY				
SIZE GPM	**MFG NO.**	**COG**	**NSN 4820-01**	**REPAIR KIT NO. 5866-**
30	2352-1351	9C	130-5413	1SK
35	2352-1355	9C	139-9899	2SK
40	2352-1401	9C	266-6754	3SK
45	2352-1405			4SK
50	2352-1451			5SK
55	2352-1461	9C	164-7070	6SK
60	2352-1471	9C	134-3753	7SK
65	2352-1481	9C	195-6345	8SK
70	2352-1491	9C	123-1568	9SK
75	2352-1501			10SK
80	2352-1511			11SK
85	2352-1521	9C	180-0935	12SK
90	2352-1531			13SK
95	2352-1541			14SK
100	2352-1551			15SK

Table 16-6e 1-½" Union Flow Control/Balance Valve with 1 ½" Body

ORIFICE PLATE AND DIAPHRAGM				
SIZE GPM	**APL NO.**	**COG**	**NSN * 4730-00 4820-00**	**REPAIR KIT NO.**
2	889900541	9C	* 911-1550	
3	889900516	9C	941-5352	
4	889900539	9C	941-8591	
5	889900537	9C	836-1068	
6	889900535	9C	911-1543	
7	889900714	9C	911-1544	

Table 16-6f Orifice Plate and Diaphragm

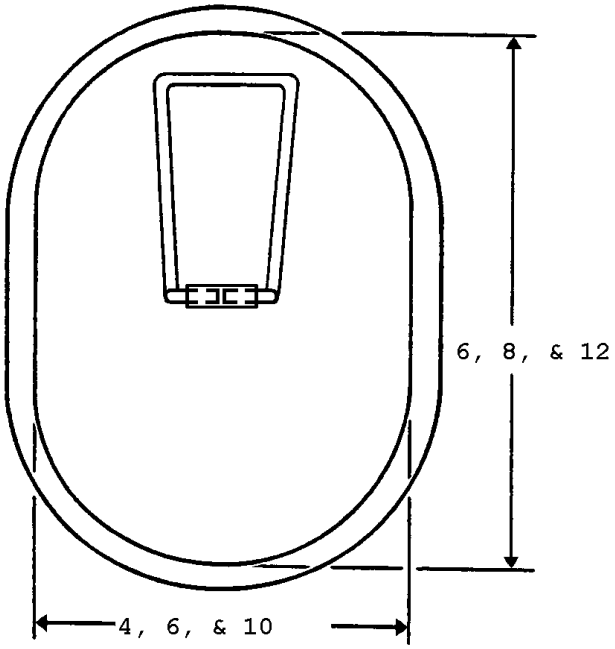


Figure 16-5 Quick Opening Access Cover, Flat Oval

PHYSICAL DATA	ORDERING DATA	
SIZE (INCHES)		LOCAL SHOP STORE NO.
4 X 6	SLIDING ACCESS	LLS012011
6 X 8	SLIDING ACCESS	LLS013059
10 X 12	SLIDING ACCESS	LLS040442
4 X 6	INSULATED	
6 X 8	INSULATED	LLS040444
10 X 12	INSULATED	LLS040443

Table 16-7 Quick Opening Access Cover, Flat Oval

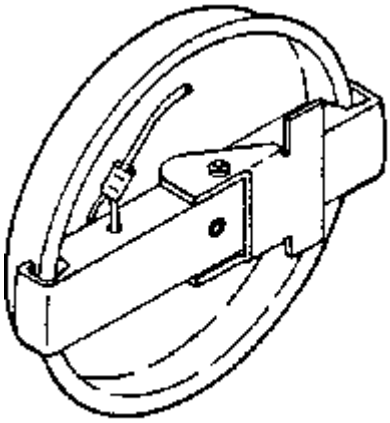


Figure 6-6 Quick Opening Access Cover Round

SIZE (INCHES)	ORDERING DATA	
	COG	NSN 2040-00
6	9G	616-5407
8	9G	616-5409
12	9G	616-5408

Table 16-8 Access Cover, Round

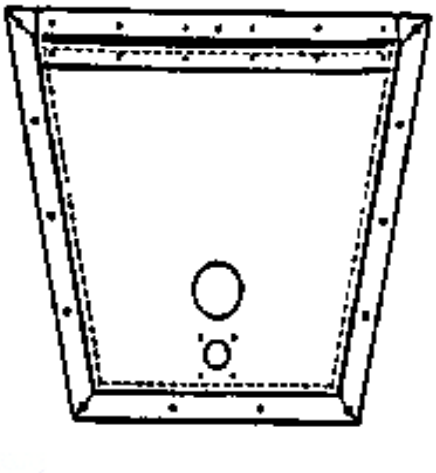


Figure 16-7 Flush Type Access Cover

Note: For details see NAVSEA Std Dwg 803-6397256
For further reference see Juniper Industries, Inc.

"Marine Ventilation Equipment" Catalog, CAT 90A.

SIZE (INCHES)	ORDERING DATA	
	COG	NSN 2040-00
6	9G	616-5412
8	9G	616-5427
12	9G	616-5428

Table 16-9 Access Cover Flange

Note: For details see NAVSEA STD DWG 805-1363775

HEATER SIZE	PHYSICAL DATA		
	FACE DIMENSIONS (INS)	ACCESS COVER SIZE (INS)	QTY
21	6 x 3 1/4	6 x 6 SADDLE	1
22	9 x 3 1/4	6 x 6 SADDLE	1
23	14 x 3 1/4	12 x 12 OR 12 x 8 x 10	1
24	9 x 6 1/4	8 x 8 OR 8 x 6 x 8	1
25	14 x 6 1/4	12 x 12 or 12 x 6 x 10	1
26	22 x 6 1/4	14 x 14 or 14 x 8 x 12	1
27	22 x 9 1/4	14 x 14 or 14 x 8 x 12	1
28	30 x 9 1/4	12 x 12 or 12 x 6 x 10	1
29	30 x 12 1/4	12 x 12 or 12 x 6 x 10	1
30	30 x 15 1/4	12 x 12 or 12 x 6 x 10	1
31	42 x 12 1/4	12 x 12 or 12 x 6 x 10	1
32	30 x 18 1/4	12 x 12 or 12 x 6 x 10	1
33	42 x 16 3/4	12 x 12 or 12 x 6 x 10	1
34	56 x 15 1/4	14 x 14 or 14 x 8 x 12	1
35	42 x 24 1/4	12 x 12 or 12 x 6 x 10	1
36	56 x 21 1/4	14 x 14 or 14 x 8 x 12	1
37	42 x 36 1/4	12 x 12 or 12 x 6 x 10	1
38	56 x 33 1/4	14 x 14 or 14 x 8 x 12	1

Table 16-10a Flush Type Access Cover for Heaters

FAN SIZE	PHYSICAL DATA		
	DIAMETER (INS)	ACCESS COVER SIZE (INS)	QTY
A 1/4	9.75	6 x 6 SADDLE	1
A 1/2	10.5	8 x 6 x 8 or 6 x 6 SADDLE	1
A 1	12.75	8 x 6 x 8 or 8 x 8 SADDLE	1
A 1 1/2	14.25	10 x 6 x 8 or 8 x 8 SADDLE	1
A 2	15.5	12 x 8 x 10 or 8 x 8 SADDLE	1
A 2 1/2	15.5	12 x 8 x 10 or 8 x 8 SADDLE	1
A 3	21.125	14 x 8 x 12 or 8 x 8	1
A 3 1/2	22.125	14 x 8 x 12 or 8 x 8	1
A 4	22.125	14 x 8 x 12 or 8 x 8	1
A 4 1/2	18	14 x 8 x 12 or 8 x 8	1
A 5	23.25	14 x 8 x 12 or 10 x 10	1
A 6	25.125	14 x 8 x 12 or 10 x 10	1
A 7	19.5	12 x 8 x 10 or 8 x 8	1
A 8	27.25	14 x 8 x 12 or 10 x 10	1
A 10	29.25	14 x 8 x 12 or 10 x 10	1
A 11	31.25	14 x 8 x 12 or 12 x 12	1
A 12	29.5	14 x 8 x 12 or 12 x 12	1
A 16	31.25	14 x 8 x 12 or 14 x 14	1
A 17	34.25	14 x 8 x 12 or 14 x 14	1
A 20	36	14 x 10 x 12 or 14 x 14	1
A 25	42.25	14 x 10 x 12 or 14 x 14	1
A 28	36	14 x 10 x 12 or 14 x 14	1
A 30	44.25	14 x 10 x 12 or 14 x 14	1

Table 16-10b Flush Type Access Cover for Fans

COIL SIZE	PHYSICAL DATA			
	FACE DIAMETER (INS)	ACCESS COVER SIZE (INS)	NSN	QTY
61	11 3/4 x 7	8 x 8 SADDLE or10 x 6 x 8		1
62	14 x 9 1/4	8 x 8 SADDLE or12 x 8 x 10		1
63	21 x 9 1/4	14 x 14 or 14 x 8 x 12		1
64	25 x 11 1/2	10 x 10 or 10 x 6 x 8		2
65	31 1/2 x 13 3/4	14 x 14 or 14 x 8 x 12		2
66	39 1/2 x 18 1/2	14 x 14 or 14 x 8 x 12		2
67	39 1/2 x 28 7/16	14 x 14 or 14 x 8 x 12		2
68	39 1/2 x 37 7/16	14 x 14 or 14 x 8 x 12		2

Table 16-10c Flush Type Access Cover for Cooling Coils

ACCESS COVER SIZE (INS)	NSN 5340	QTY
10 x 10 ALUM	01-322-5113	1
10 x 10 GALV STL	01-336-0728	1
10 x 6 x 8 ALUM	01-331-6355	1
10 x 6 x 8 GALV STL	01-336-2360	1
12 x 12 ALUM	01-322-3592	1
12 x 12 GALV STL	01-322-0911	1
12 x 8 x 10 ALUM	01-3235641	1
12 x 8 x 10 GALV STL	01-322-3593	1
14 x 14 ALUM	01-354-3674	1
14 x 14 GALV STL	01-336-2359	1
14 x 8 x 12 ALUM	01-396-5873	1
14 x 8 x 12 GALV STL	01-322-0910	1
6 x 6 ALUM	01-322-0915	1
6 x 6 STEEL	01-322-5112	1
8 x 8 ALUM	01-373-0228	1
8 x 8 GALV	01-336-2358	1

Table 16-10d Access Cover